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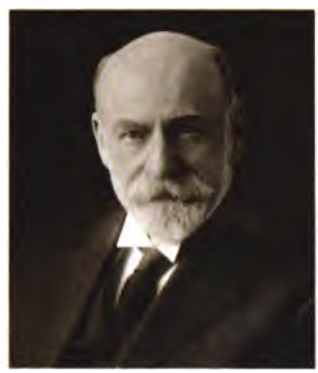

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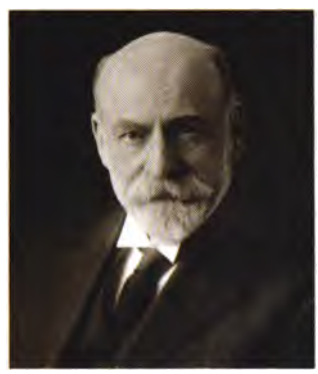

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GEOLOGICAL SURVEY OF HOKKAIDO.

A GEOLOGICAL TRIP

THROUGH AND AROUND

YESSO,

IN 1874,

AND

FOUR OTHER REPORTS,

BY

BENJ. SMITH LYMAN,

CHIEF GEOLOGIST AND MINING ENGINEER.

1875.

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J. Lesley
1008 Clinton Street
Philad a

GEOLOGICAL SURVEY OF HOKKAIDO.

23 Nov 1903 E.G.S.

REPORT

OF A

GEOLOGICAL TRIP THROUGH AND AROUND YESSO,

WITH NOTICES OF THE

TOPOGRAPHY, TIMBER, POPULATION, AINOS

AND OF THE

PROGRESS OF THE GEOLOGICAL SURVEY;

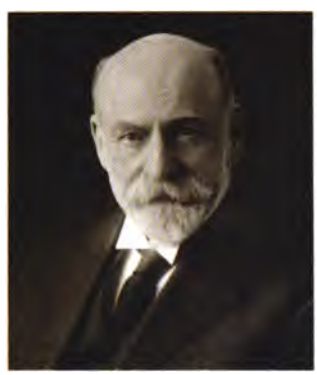
BY

1835-1920

BENJAMIN SMITH LYMAN,

Chief Geologist and Mining-Engineer to the Kaitakushi.

TOKEI:
PUBLISHED BY THE KAITAKUSHI.
1875.



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farms at Nanai 10½ miles (4¼ *ri*) distant, and returned to Hakodate the same day. The 24th was Sunday, but one party of my assistants started for Sapporo; on the 25th further preparations for departure were made; and on the 26th I set out in your company for Sapporo, and we reached Mori, 28¾ miles (11½ *ri*), the same day.

The 27th of May, we crossed Volcano Bay to Tokarumui, or Shin (New) Mororan, in a diminutive steamer that had hard work in rather rough water to finish the passage of about 25 miles (10 ri) in seven hours and a-half. The 28th, we viewed the site of the new saw-mill across a small arm of the harbour, and made some soundings in different parts of the Bay near by. In the afternoon we rode out a ri or more on the new road to look at some places proposed for new settlements. The 29th was spent in an excursion to the farming settlement at Mombets on the shore of the Bay near Usu. We went across in the little steamer; afterwards rode from Mombets and old Mororan, and re-crossed in the steamer again. We had to stay at Tokarumui the 30th, on account of heavy rain; and the 31st, Sunday, because news came that the Horobets having no bridge was too high to cross otherwise. On the 1st of June, however, after a walk in the morning to the top of the neighbouring mountain where a trigonometrical signal had just been put up, news came that the road was passable, and we rode the same day to Horobets, 12½ miles (5 *ri*).

On the 2nd of June, we rode by Shiraoi to Tomakomai 31 miles (12½ ri); passing on the way the Tarumai Volcano to our left. A man at a tea-house on the road opposite the Volcano told us that the late eruption began at noon on the 8th of February last, and continued until noon the next day; but that it was most active from five in the afternoon until two o'clock in the morning. The woods and bushes were set on fire to a distance about

half way from the crater to the tea-house. The material thrown out was pumice of a light brown colour in pebbles about the size of a filbert; and it covers the ground, partly burying the grass, and rests on the roofs of houses along the road to a depth of about three-tenths of a foot, but is confined to a short space only. The smoke rising from the volcano when we passed was much more conspicuous than it was last year, and about ten times greater in quantity, the man said. Nobody had yet gone up to the crater since the eruption.

On the 3rd of June, we left the sea shore, which we had so far followed with its narrow plain of pumice and with its mountains to our left; and rode inland still on the New Road by Stose (Chitose) as far as Shimamap about twenty seven miles and half (11 ri.) Near the hotel there was the first rock exposure, a layer of compacter pumice than usual, or perhaps trachyte, some ten feet thick, in small cliffs and in a cutting on the road. On the morning of the 4th, we rode on to Sapporo, thirteen miles and three-quarters (5½ ri), over a rather broken country most of the way, as indeed it had been since leaving Chitose.

On the 5th of June, we visited the Governor of Sapporo in the fine new capitol building; and on the 6th went with him towards Zenibako to look at some lands intended for settlers. A rain storm on the 7th, kept us in the house all day; but some of the preparations for the field work were continued. On the 8th, we again rode out with the Governor of Sapporo to visit places that had been selected for new farm settlers. On the 9th, wet weather, prevented my assistants from setting out (by boat) for the Ishcari coal fields, but they came and received lengthy instructions. The high water of the river kept them from starting on the 10th also; but on the 11th, in spite of doubtful weather which really turned out rainy,

they went in canoes down the Toyohira. The 12th, 13th, 14th, 15th and 16th. were still either rainy or so threatening that by your advice I did not set out myself, although at length all the preparations had been finished.

On the morning of the 17th, however, the weather seemed finally to have cleared off, and my assistant Mr Akiyama and my interpreter and I started in boats on the Toyohira about a ri from Sapporo. We had two large row boats and eleven canoes manned by Japanese coolies and by Ainos, and loaded with our baggage and large supplies of rice and other food, enough for our trip up the Ishcari and some of its branches and across the mountains until we should meet some boats sent up the Tokachi river with food for us, a journey that it was reckoned might last seventy-five days. We had with us, besides the crews, two servants and two Japanese coolies. The river where we started was said to be about half a foot higher than common.

Camp on the Ikusubets, 22nd June, 1874.—After leaving you we went quickly down the Toyohira to its mouth on the Ishcari at Tsuishcari, in about three hours; and found the river there a dozen feet higher than usual. Mr. Akiyama sounded frequently on the way down and the least depth was five or six feet, generally there was as much as ten feet at least. Near the mouth of the river the flat land at the sides was in some places very widely overflowed. Most of the way the timber looked very unpromising, scarcely anything but small (or rather small) willows and those in many places very thin. Some of the empty houses that we saw last year at Tsuishcari have been torn down, and the two or three remaining ones are occupied, and all the cleared land seems to be coming into cultivation and is fenced in. Some men were busily at work grubbing and digging, a much better sight than the desolation that was to be noticed there last year. There

appeared, however, to be no spare house room for passing travellers, and the weather too was not so unpromising (although cloudy) as to justify staying there. So after leaving behind one of the big boats as too slow compared with the canoes (to one of which I betook myself) we went on as far as to the mouth of the Ebets, the river that heads up on one side near Chitose, and the one which we were to explore a little towards its other head-waters on the North towards Yubari mountain. We camped near the mouth, having some difficulty in finding dry ground.

The next morning (18th June) the interpreter and I went on up the Ebets with seven canoes and three Ainos in each, besides my two servants and the two Japanese coolies and ten days' provisions. We paddled along most of the way among the trees that bordered the river, for the banks were overflowed. At noon we reached the Yubaribets branch, and went up it several miles that afternoon passing through a wide lake-like expanse of water. The next day (19th June) we went on some miles further in the morning, finding the river now within banks, and having here and there pebbly beaches which contained pebbles of coal. The afternoon was very rainy and we staid in camp.

It cleared off the next morning (20th June) and we started (after an early lunch) before noon and went on to a point just beyond two large branches, one on either side at a distance of about thirty miles from the mouth of the Ebets. As we found coal pebbles at that point and therefore proof that coal outcropped on the waters of the main branch above the mouth of the side branches of any size, we went no further. We had also seen rocks exactly like those that accompany the coal of the Horumui field. It was therefore certain that the coal field reached to the upper valley of the Yubaribets, and that it would be worth while to extend the survey from the Horumui so far at

least in that direction. I am curious to learn whether the topographical surveys now in progress on the streams further to the southwest which empty into the sea beyond Yubuts do not also show the presence of coal by such coal pebbles. It seems very likely that the coal reaches as far as Mombets (near Uragawa) without interruption ; and in that case it forms a very important coal field. It would be very fortunate if it should turn out that there is some feasible place for an artificial harbor beyond Yubuts, as it would very much help the shipment of the coal.

The timber that we saw on the way did not on the whole seem very valuable, especially on the lower waters, where it was chiefly willow. On the upper waters was some good timber. On the other hand there was a great deal of open prairie land, particularly one very long prairie on the left bank of the Ebets, which must contain some five thousand acres or more. If a road should be built straight from Sapporo to the coal we surveyed up here last July, it would pass right through that prairie. Near the mouth of the Yubaribets there is on that stream a great deal of low wet land.

The next day, 21st June (yesterday), we came back rapidly with the current to the mouth of the Ebets where we had left Mr. Akiyama with the rest of the boats and men and baggage. On the evening of our first arrival there, some additional Ainos from Ishcari that had been engaged joined us. Night before last, before dark, the Ainos played an interesting game; two parties some twenty yards apart threw back and forth a ring some six inches in diameter which the opposite party tried to catch upon long poles (like lances), probably the ones they had been poling the canoes with. It was a very picturesque sight to see them rushing forward eagerly with spears high in air trying to catch the ring.

This morning (22nd June), we all came up the Ishcari to the mouth of the Horumui; but the interpreter and I, as before, left Mr. Akiyama and some of the men and boats there, and came on up the Horumui with half a dozen canoes and for greater speed four Ainos in each. About noon we reached the mouth of this branch of the Horumui (the Ikusubets, as they insist it should be called, though according to the Map of Matsura it should be the main stream). As we were coming up, towards camping time, we were suddenly met by the canoes from above which carry this to you, on their way back from our surveying party at Poronai.

Camp at the mouth of the Horumui; 30th June.—We camped once more on the Ikusubets on the 23rd of June, and reached the coal region at Poronai the following morning (24th), and camped alongside of the young gentlemen who are surveying there. The rest of that and the next day (25th) were spent in receiving information from them about their work, in giving them various instructions and in testing their compasses. We were kept there two days more (26th and 27th) by rain, and one by Sunday (28th), and came away yesterday morning (29th). The delay gave me a chance to make a little map from my sketches (last year and this) of the Toyohira, Ebets, Yubaribets, Horumui and Ikusubets. According to this map (which differs very much from the printed maps), it is eleven ri by the river from here to the mouth of Poronai, probably about five ri across from the coal north-westerly to the Ishcari river, and also about five ri north-easterly from the coal to the Sorachi coal region. The young men are to run a line to the Ishcari and another to the Sorachi coal region, determining as well as they can the limits of the coal all the way. While at Poronai I improved the opportunity for giving all the young men some lessons and practice in the measurement

of logs, standing trees and forests, in hopes that some of them at least would be so much interested as to make such measurements now and then during their season's surveying, and so be enabled to give us at least a rough idea of the amount of wood, fuel and timber in different spots.

Sorachibuto ; 8th July.—My letter of the 30th of June had hardly gone when the weather improved, and we set out at once up the Ishcari ; and that afternoon reached the narrow neck of only seventy feet in width where the Ishcari winds around for a couple of miles at the mouth of the Bibai river. We camped on the neck (called Bibaidap), and the empty boats were all hauled across within ten minutes, except one boat, which being in advance and manned by strangers did not notice the neck and went all the way round and was astonished to find our tents already pitched on the shore far in advance of them when they came in sight. With the hand level we found the difference of level of the water on the two sides of the neck to be 1.9 ft. The bank is already cut down by the floods to within about two feet of the level of the water on the upper side.

The next noon (1st July) we reached the Shibets, a small river or large brook on our left going up. We spent some time in searching for bits of coal, and found them not only at the mouth where the Ishcari might have dropped them, but full half a mile up stream far out of reach of the Ishcari. So it is pretty certain that the mountains to the northwest contain coal on this side, probably a continuation of what is already known on the other side (on the west coast) ; so that the coal there also probably covers a large space. We went that afternoon to Tomushi, a small brook, and camped on the beach.

The next day (2nd July) brought us some distance above Naye brook, and on the way we passed an Aino

village of some five houses at Urashinai, and picked up some Ainos of the Middle River region. Their salutations with some of our former men at the first resting place we came to were very elaborate and grave and silent; and were not even followed by any talk at first, and evidently there was no desire to learn the latest news on either side. That afternoon we passed Kabato river on our left, but it was so insignificantly small that I did not recognize it nor know of it until we had gone far beyond next day.

The next day (3rd July) we arrived here at the mouth of the Sorachi before noon, and after leaving some of our luggage, boats and men we went right on up the Sorachi. We picked up an Aino guide, a fine looking man, at a village of two or three houses a mile or so above the mouth of the river; but it turned out next day that Tetta, one of our Ishcari Ainos, had been five days journey up the Sorachi to a (fifty foot?) high water fall to catch fish, and knew as much about the coal as the guide did.

We had to camp at the Borato brook, a mile below the nearest coal, and the next morning (4th July) went on five miles or so to the principal exposures at Kebushinai. All the exposures are in the cliffs along the banks of the Sorachi. We stopped and measured the beds of coal and some of the rocks as we went along. They said there was no coal further up, but that evening I found some large lumps of it on the beach a quarter of a mile above, and the next morning (5th July) we went beyond and found still a very fine set of exposures of all the coal beds. Owing to the windings of the river and the changes of dip of the coal beds, these are exposed each two or three times. The beds (to tell the best of the story first) are very fine as to thickness and some of them as to quality. The thickest coal bed has the enormous thickness of nineteen feet at one place, but not the best quality; at another

place a thickness of thirteen and a-half feet of coal; another coal bed has eight feet and seven-tenths of thickness and the best quality at two places; another, six feet and six-tenths and the best quality; besides that, there is a bed of four feet and a-half, one of four feet and one of three feet and a-half, making six workable beds, and a thickness in them, all together, of about thirty-six feet. The thickness, however, varies very much at different points. As for quality the appearances are good; but we have taken samples for assaying from the different workable beds; as Mr. Enomoto's last year was probably selected of the very best quality, not as an average, and he did not know certainly from which bed it came.

The hills, however, to begin the darker side of the story, are so very low just about the best exposures as to give a very small quantity of coal above water level. There are, however, hills of some height to the north-east close by and the coal doubtless runs into them, and perhaps can be opened in them quite as near to the Ishcari as these Sorachi exposures. But the great difficulty is in regard to shipment. The Sorachi, though two hundred feet wide at the mouth is a very shallow stream, say about the size and depth of the Toyohira at Sapporo, and, and like that, very rapid, with numerous ripples where even the canoe touched bottom, although since that the river here has gone down a foot and a-half. The banks are low in many places, say four or five feet high for long distances, so that even damming without long levees would not give much depth of water. The distance by river to the nearest coal (and though that is poor, the others could probably be opened near by) is about three ri and a-half ($8\frac{3}{4}$ miles), and the distance straight is about two ri (5 miles); or to Kebushinai two ri and a half ($6\frac{3}{4}$ miles). As the coal must of course be sent by a tram road to the Ishcari, the advantage of near-

ness as compared with the Poronai (Horumui) coal is almost lost; for when the coal is once on a car it does not matter so much whether it has to go two ri or five. As to the depth of the Ishcari too, Mr. Akiyama (who sounded as we came along) reports a depth in the channel of only seven feet at several places this side of Urashinai, and since that the Ishcari here has gone down at least a foot and a half. So that it will not be possible to bring up very large vessels so high. Besides the distance is of some importance, for although the swift current would take the loaded vessels down very well, yet it would certainly be a little troublesome to bring even empty ones back again. The distance to Sorachibuto (buto means mouth) from Horumuibuto is about twenty ri or fifty miles.

But the nearest point probably for shipping tho Poronai coal would be at the mouth of the Bibai, some five ri or twelve miles and a-half above Horumuibuto; and up to the Bibai neck Mr. Akiyama found everywhere at least twelve feet of water. I have hopes that they will find the coal reaching from Poronai some distance in that direction, so as to shorten the distance (about five ri and a-half) by a couple of ri; and there is a rumor to the effect that some such coal has been found already by a man that is now with the party in Poronai. That seems to me (at present) decidedly the best region for opening coal in the Ishcari valley. Its greater nearness to Sapporo and civilization would make the opening of mines there easier at the outset and cheaper to oversee and keep supplied with food. A road of only eleven ri or twenty-seven miles and a-half would reach from Saporo to the coal mines. A railroad of less than fifty miles would reach from the mines to Otarunai passing near Sapporo. . But perhaps a still more convenient point for mining coal will be found near Rurumoppe (north of Ishcari) on the west coast, for there is coal known in a neighbouring valley,

and it seems quite probable that there is a large field of it in those mountains.

We reached Kebushinai on the 4th of July, and staid there over the next day, Sunday, and came back here on Monday, (6th July), after taking the samples. Yesterday, (7th July), and to-day, I have been finishing sketch-maps, sections and instructions for the guidance of Mr. Yamauchi and his party when they arrive in this region The big boat having carried its load some distance above this, returns now.

Kamoikotan (or Cliffs of the Ishcari); 11th July.—On the 8th, after finishing my letter to you, we set out again on our way up the Ishcari, although it was about two o'clock. We reached in less than a mile the Tuppu river which is put down on the maps as somewhat higher up. We went a quarter of a mile up stream on it, and searched carefully for bits of coal among the beach pebbles, and at length found a large number of very small ones; showing that there is probably coal up the river though a good ways from the mouth. The river comes to the Ishcari from the West, and at the mouth is some fifty feet wide and perhaps three feet deep.

A quarter of a mile above its mouth we passed, on the easterly bank of the Ishcari, a village of five Aino houses, some of whose inhabitants were on the bank looking at us; but considering the rareness of foreigners in these parts there seems to be less curiosity about them than you would expect. Our own Ainos however show a good deal of curiosity when I take my daily swim in the river, and they are probably surprised to find that I am more hairy than many of themselves, though a good deal whiter. I am satisfied that on the whole the Ainos are no more hairy than Caucasians; for I know old school mates or others that are still more hairy than I am, though perhaps not so much so as the hairiest of our Ainos; and there are

longer beards in America than any of our Ainos' beards. One of our young Aino men, or rather a boy, though about full grown and doing a man's work very ambitiously, has no beard at all, and several of the others have very little to show of that kind. Even the bushy heads of hair would not be noticeable at home if well cut and combed; a friend of mine there used to have just such a head of hair. Two or three of our Ainos, however, are very hairy; one in particular has shaggy epaulets of hair on his shoulders, besides much on his breast, shoulder-blades, arms and legs; but he seems to be quite an exception.

Less than a mile and a-half above the Aino village we came to the Shushun river on the westerly shore; but although given on the printed map as a large long stream, it is really but half a dozen feet wide and a foot or so deep. We spent some time there in pushing through a thicket for half a mile or so to find some pebbly beach; but the river flowed everywhere through merely mud, and the search was given up. We went but half a mile further up the Ishcari before we camped for the night; having come in all about two miles and a-half (a little over a ri).

The next morning (9th July), we reached the Oshirara river from the West or north-west, and found it some thirty feet wide and perhaps six feet deep. We searched carefully through a bed of pebbles without finding any traces of coal, and so gave it up. In the afternoon we reached the Uriu river on the northerly shore of the Ishcari: and very quickly found on a pebble beach abundance of coal bits even up to the size of a turkey's egg. The river is about a hundred feet wide and three feet deep. It leads towards Rurumoppe, and its coal is probably part of the same field with that of Rurumoppe. The size of the lumps seemed to show that the original bed was not so very far distant. About a mile above that we passed the Aino village called Memu, one of three houses.

That day we went about six ri and a half by my reckoning.

The next day (10th July, yesterday), we had no tributary rivers of importance to search for coal bits; though we reached here and had from time to time to stop to look at rocks of geological interest; for we are now in the midst of the mountains and on the last part of the way passed numerous rock exposures. We saw enough to convince me almost that the two groups of rocks I called in my report of last Christmas the Toshibets Karafto and the Horumui Karafto are one and the same; although there are some singular geological facts connected with the group. If so, the rocks that I took last year to be underneath the Horumui coal are newer and perhaps cover it in places. Those rocks were almost the only ones we saw yesterday, but on arriving here towards night we found different and older rocks which I have not yet examined closely. Among them, however, is at least a little lime-stone, but I have searched all the way up the Ishcari and on the side streams in vain for any pebbles of lime-stone. On the Sorachi to be sure was a little lime-stone near the coal, in balls, and it seemed so heavy as to be fit for iron ore. It was, however, too little in quantity to be worked except one four inch seam close under a good coal bed, which could therefore be taken out easily enough. Iron ore indeed is what now seems most lacking for the future manufacturing prosperity of Yesso, and it is hard to believe that so large an island should not have it abundantly in some place.

As for coal, any body not familiar with such calculations would be astonished to find to what large numbers of tons it counts up. Take, for example, the border of the field from the place of last summer's survey (Poronai) to the Sorachi region, and call it in all, say twenty miles (eight leagues, or ri) long; and call the average thickness of the workable beds, altogether thirty feet, or ten yards;

and the average height to which the beds extend above water level, one hundred and five feet, with an extent therefore along the slope (of say 45 degrees) of fifty yards. Then for every running yard there would be 500 cubic yards, or say tons, of coal above water level, and in a running mile 880,000 tons, and in the twenty miles 17,600,000 tons; and if, as is probable, there be everywhere as at Poronai and at Sorachi two rock saddles at least, so that the coal may be found on both sides of each, making four outcrops of each bed, there would be some 70,000,000 tons of coal above water level. If this border of the coal field be, as may very well turn out, but one side of a field that is also quite as wide, then the whole of the boundary would probably have three or four times as much coal above water level besides what fills np the interior of the field. But so far only the coal above water level has been mentioned; the coal below water level would be as much more for every hundred feet of depth, or in a depth of four thousand feet (the limit of workableness, as is supposed), there would be forty times as much more. And yet, although we have already got up among the thousands of millions of tons, we have been estimating the probable contents of but one field and that not so very large, while the bits of coal in the rivers seem to show that there is another field perhaps as large on the West Coast near Rurumoppe, if not much larger reaching northward. If the Kaitakushi should go to work with might and main at coal mining with the help of a railroad up the East side of the Ishcari to the Sorachi with branch roads to the mountains, or with railroads to other points, there is already no danger that it could exhaust its coal resources in centuries. In saying so I take the Horumui (Poronai) coal to be continuous with that of the Sorachi, as is almost certain from the great resemblance of the section of the rocks at the two places, in spite of the

thickening of the coal beds on the Sorachi, and as is not at all improbable from the nearness in a straight line, only some fifteen miles (six ri). The mining need only be limited by the demand for coal; and if good iron ore can be found, the manufacture of iron would consume an indefinite quantity of coal.

Here at Kamoikotan, the rapids and narrow pass which divide the Middle Ishcari from the Upper Waters, there is after all no water fall, only boiling rapids for a ri or less in length. We are camped on a small bit of flat prairie land, a quarter of a mile above the lower end of the rapids. Yesterday, we passed a good deal of open prairie land and latterly a good deal of light timber: but lower down the river the timber is generally pretty heavy, though not commonly extremely close. Some of our canoes, the best, are towed up the rapids to the Upper Waters, and the rest are sent home again. It is said now that it is not possible to cross from the head waters of the main stream to the Tokachi, but that you can cross from the head of the Chubets to the Tokachi; so it is still undecided which pass we shall try, or whether we shall not go first up the main stream to the water-fall said to be two thousand feet high (where the impossibility of crossing on account of the steepness begins) and then come back and go across by the Chubets.

I have the honor to be,

Sir,

Your most obedient Servant,

BENJ. SMITH LYMAN.

FROM KAMOIKOTAN ACROSS THE MOUNTAINS TO OHOTSUNAI.

NEMORO, YESSO, 26th August, 1874.

GENERAL HORACE CAPRON,
Commissioner and Adviser to the Kaitakushi.

MY DEAR SIR,

You have taken such a lively interest in my work that you may not find amiss a more detailed account, day by day, of the journey across from the Ishcari to the Tokachi; although the edge of your appetite for it has perhaps been taken away by the somewhat lengthy letter that I scribbled off the other day at Ohotsunai.

12th July, 1874. Sunday.—In the afternoon we moved the camp from a quarter of a mile above the lower end of the Kamoikotan rapids to Harushinai, a small brook at the upper end of the rapids, a distance of a mile (15 chô) and about due east. The tents and baggage were carried by the Ainos on their backs; their own luggage and the rice had already been carried, and the best of the canoes had been towed there against the current. There is no waterfall at Kamoikotan, only very strong rapids with

many rocks in the stream. The interpreter's levelling with the hand level made the fall from beginning to end of the rapids 54½ feet; the distance as already shown is about a mile and a-quarter or half a ri. The distance is rather roughly estimated from the number of my steps, which were, however, irregular in length and crooked in direction.

The path is nowhere difficult, and the hills nowhere press so closely upon the stream as to make the building of a road or even of a railroad very difficult. About half way between the two camps some huge (10 ? foot) blocks of dark greenish or brownish almost black serpentine are seen and from being highly polished by the water are much admired by the Ainos, who rub the smooth surface and put their eyes close to it to see the reflection. From the size of the blocks the bed they come from must be at least five feet thick, probably it is much more. The other rocks along the shore are metamorphic talcose and quartzose schists and dark quartzite with a strike of about north and south; and probably belong to the Toshibets Karafto group of rocks. The lime-stone at the lower end of Kamoikotan rapids has already been mentioned. It is a blue marble with white streaks, in appearance a good deal like the Pennsylvania marble, much used in Philadelphia for door steps and other building purposes. The thickness of the bed is at least, seven feet and perhaps much more. The marble and the serpentine will both yield valuable handsome materials for ornamental uses, for chimney pieces, table tops, floors, door steps, pillars, and the outer walls of buildings. The supply will probably be quite large enough for the demands of Yesso, and may even be sent to Nippon, if there be no nearer and more convenient quarries of like material. Neither the limestone nor the serpentine was found again above Kamoikotan, unless possibly some of the polished

blocks in the river a short distance above the rapids were serpentine; all those tried proved to be quartzite. But many small bits of serpentine were found among the pebbles of the Harushinai brook, close above the camp; though none of limestone nor of coal were there.

This morning, before we started a mystery was solved that had puzzled me for some days. The Ainos had now and then produced with some kind of pipe very melodious flute-like notes, that seemed by their sweetness to show great musical taste, though there was seldom even an approach to a time. It turned out that the hollow stem of a tall weed, four or five feet long. was blown through at the small end, and the variation in the notes was produced simply by the natural breaking up of the vibrating column of air into halves, quarters, thirds and the like.

13th July.—We set out this morning with eleven dug out canoes and five Ainos to most of them, four to the rest; forty-eight Ainos in all. A few Ainos and all the Japanese boatmen had been sent back from Kamoikotan. We had still with us, besides the Japanese cooly interpreter for the Ainos, two Japanese coolies, my cook, my boy, Mr. Akiyama (assistant geologist, quarter-master, entomological collector and sounder of rivers) and the interpreter (acting also as assistant geologist and botanical collector); making with myself fifty six men in all.

The current was at first still very strong with many large rocks in the stream, and the strength of the Ainos was well strained. A couple of miles above the Harushinai camp we came however to a place where the river was for a short distance free from such rocks and straight with a uniform current, and we stopped to measure it roughly. We found the width to be about 300 feet; the depth at three points about 75 feet apart from one another and from the shore to be 2.7 feet, 5.8 feet and 2.3 feet; and the greatest surface current velocity to be five feet a

second. The discharge then is about 3,240 cubic feet a second; or as one or two small brooks had been passed above Kamoikotan, the discharge at Kamoikotan is in round numbers about 3,250 cubic feet a second. This with the fall of 54½ feet would give a little over sixteen thousand horse power (allowing 20 per cent for loss of power by the machines) enough to run the mills of a large town. A dam of fifty-five or sixty feet in height at the lower end of Kamoikotan would be short, because the hills there come near to the river on either side; it would perhaps be hardly two hundred yards long at the top (the river itself is perhaps a hundred feet wide). From three-quarters of a mile to a mile (10 to 15 chô) at most below the place for a dam there is a flat plain, mostly an open prairie on either side of the river which would give building room for a large town. It seems perhaps wild to speculate on the building of mills here with nothing at present to manufacture; but the day will certainly come when this magnificent water power will be used for working up material brought a less distance than the raw stuff is carried that chiefly occupies the mills of the Merrimac. Meanwhile these 16,000 horses are running loose day after day, and as many more night after night, with nothing whatever to do.

A little before noon, we reached in about four miles (1½ ri) from camp the Etambets, a considerable stream on our left which I roughly estimated to have a discharge of seventy cubic feet a second. We went up it some three hundred yards and searched carefully among the pebbles, but found no trace of coal nor lime-stone nor volcanic rock, and very little serpentine. The pebbles were almost wholly (or quite so) of highly metamorphic rocks.

The Ishcari flowed still between hills, but not very high ones (say 250? feet high); near Kamoikotan they were perhaps 500 feet high. The hills on our left continued

(but growing lower and lower) as far as the Osarappe a small brook a mile or so (half a ri) above the Etambets; but on the right the hill ended at least half a mile lower down stream. In flowing among these hills the river has exposed the solid rock in a few places; and it is always a dark grayish highly metamorphic sandrock or quartzite with a strike of about north and south and a dip of forty-five or fifty degrees westerly.

Above the Osarappe the current becomes a little less violent, and we soon came to a fish-weir, the first we had seen since leaving the Toyohira, and the first sign of the Aino settlements of the upper Ishcari. About a mile (15 chô) above the Osarappe we came to the Chubets on our right, a river a hundred feet or so in width with a discharge of perhaps 550 cubic feet a second. A short distance up it is the "Obanya," which figures so largely on Matsura's map that you would suppose it at least to be a very important trading post. It had been agreed that we should stop near here, even if we arrived early, in order to give our Upper Ishcari Ainos a chance to visit their homes or neighbours. But before camping we went on a mile and a-half further up the Ishcari, passing an Aino house on the way, and stopped at a good clean wide beach of sand and pebbles opposite another Aino house; having accomplished according to my sketching 7¾ miles (3.1 ri) in the day.

We had come into a beautiful level region with prairies and light woods, and with distant mountains in almost all directions and with Ishcaridake towering up before us to the east, with many large snow patches on its top. It was impossible to help exclaiming that this was the Cashmere of Japan. I insisted that if the Mikado should come to Sapporo next year he should by all means be brought to the upper Ishcari; for the trip would be a very easy one and he would not only be delighted with

the scenery and with the wildness of the region, but would enjoy the novelty of a little camp life, which could easily be made as comfortable and luxurious as could be wished. The greatest Mogul Indian Emperors travelled much with a camp, and sometimes most luxuriously. A river steamer drawing less than five feet could go all the way from Ishcaributo to within fifteen miles (6 ri) of Kamoikotan, and by deepening one place of three feet deep, some one hundred yards long, it could go to within a mile or so of Kamoikotan. The distance is about 110 miles from Ishcaributo and could easily be run in ten or eleven hours. From the landing place a wagon road of seven or eight miles could be made without trouble into the heart of the little paradise of the Upper Ishcari. His Imperial Highness could therefore sleep on the comfortable river steamer at Ishcari (or on the sea steamer), could start at dawn or a little later, arrive at Kamoikotan by 4 o'clock in the afternoon, and be taken in a comfortable coach by 5 o'clock to a camp either near where we camped or on some of the hills nearer to Kamoikotan. One of the hills was said by the interpreter to resemble a famous mountain in his country, where there was once a great city. The steamer, if allowed to, might make daily trips and bring up any number of followers of the Court as well as supplies of food. If the Emperor were so inclined he could indulge in a little hunting ; and he could even set apart the whole of this little valley for his hunting park. But I trust that its plain will rather be covered with grain to be ground at the mills of Kamoikotan and with flax to be made there into linen. If the Emperor should come once, he would surely wish to come often ; as those Great Mogul Emperors used to go to Cashmere, a far lengthier journey ; and he would perhaps like them build a fine summer palace and baths, and he could ornament them with the marble and serpentine of Kamoikotan.

As we had reached our camp ground by half past two, Mr Akiyama and the interpreter and I, wishing to see the famous Obanya and finding there was no path across by land, took one canoe and a few Ainos and went down again to the Chubets, and up it half a mile, then up a small high water channel on our right for half a mile more. There in the tall grass we found a solitary frame building about fifteen feet square, closed and deserted; and this was the Obanya! Close by were the fallen rnins of a house that had been there, but at present there is no habitation near. The Obanya is (as it turned out) a sort of store-house built about twenty years ago by a tradesman of Ishcaributo for use in connection with the salmon fishery. By peeking through the cracks we saw the building was nearly empty, but perhaps with some nets and the like lying on the floor. So here was dispelled our vision of a great mercantile establishment.

The pebbles of the Chubets seemed to be wholly of metamorphic or volcanic rocks without any bits of coal or of lime-stone or of serpentine. And the beach at the camp had only the same kinds of pebbles.

14th July.—This day we went, by my sketching, 19¼ miles (7.7 ri), more than we used to make in a day on the Lower and Middle Ishcari; probably because, as the river has grown narrower, less time was lost in crossing the river from side to side at the bends, to avoid the swiftest current, and poles were used instead of the oars more constantly than before. The measurement of my sketching is very rough, yet to a certain extent consistent with itself. The sketching is aided by a sort of triangulation; on the covers of the note-book lines are drawn from the corners at an angle of 45 degrees with the sides, so that when the edge of the book is held parallel to the river or to the boat, sights can be taken square across the river and forward (or backward) at an angle of 45 degrees

with that, and if the boat, as usually happens, is close to one bank, of course, the sights cut off on the opposite shore a space equal to the width of the river. Knowing roughly the width of the river, one such space and angle after another is plotted roughly by the eye and with the help of a pocket compass (best, one hung on gimbals) in the lap or on the bottom of the boat. I do not yet know how accurate the sketching may turn out as compared with an instrumental survey; but at the mouth of the Tokachi my sketch of about 265 miles (106 ri) from Sapporo differed in latitude but seven miles and a-half (3 ri), about three per cent, from that given on Matsura's large map. About one-third of the sketch too was of the journey on foot and probably less exact or uniform than the boating part. The difference in longitude was greater, but corresponded well to the error we found in Matsura's map at the dividing range; and somewhat with the error of thirty miles (12 ri) in longitude that is said to exist in the maps a little further east at Nemoro.

The river at starting this day was in one channel about 240 feet wide, but afterwards was much broken up into small side channels forming islands. Such channels the Ainos call Makumbets; high water channels or old ones they call Fushikobets. The current as we went on grew stronger and the violent rapids more and more frequent.

The country continued flat and here and there were a few open prairies, but generally the land, at least near the river, was covered with light woods. Indeed, we found above Kamoikotan no heavy timber to speak of until the very day we crossed the mountain to the Tokachi or the day before. Perhaps however, the woods further back from the river and on the mountains may generally be heavier than what we saw. It is probable that the soil of this Upper Ishcari region is not very rich as it apparently comes chiefly from very siliceous materials. Yet

on the flat plain the soil must in part come from volcanic rocks and may therefore be rich.

We found the size of the branch streams sometimes to vary from what it would appear to be from Matsura's map. The Purebets for example on our left was some twenty feet wide with a roughly estimated discharge of sixty-five cubic feet a second ; the Ushishipe on our right was perhaps fifteen feet wide with a discharge of say forty cubic feet a second ; and there were some other much smaller streams.

15th July.—We started about seven, our regular hour, and reached the mouth of the Aibets, four miles and a half (1.8 ri) by my sketch, a few minutes after ten. As I had been quite overcome by the heat or the fatigue (or both combined) of the day before, and had with difficulty struggled along in the morning, and as it had been raining for two hours, I was happy to believe that it had set in to rain all day, and had the camp pitched. By noon, however, it had cleared up ; but my illness was willing again to use the excuse that our geological assistants regularly have Wednesday afternoon as a half holiday ; so we stayed there over night.

The Aibets is some twenty-five feet wide, with a comparatively gentle current and with a discharge of perhaps fifty cubic feet a second. Its pebbles are in great part of volcanic rocks ; the rest are metamorphic or crystalline ; a few are of a gray syenite ; fewer than has been usual in the streams below are of black or blackish fine grained quartzite.

From the mouth of the Aibets to Sorachibuto and indeed you may say from Tsuishcari (near Sapporo) the general course of the Ishcari is south-westerly, but above the Aibets its general course is northwesterly, about at right angles,

The mouth of the Aibets was Mr. Wasson's furthest last

year. In his first trip it was of course useless to search further for a convenient place for a geodetic base line; and in the second trip the approach of winter prevented his surveying beyond.

Above this we met with no Aino houses nor signs of their presence; and below we had seen but three or four of their houses since leaving Kamoikotan. Yet the Aino population of the Upper Ishcari is reckoned at 200.

Our Ainos said that no one had ever crossed by the Aibets valley to the northeast coast; but so far as we could see and judge by the map it would be easy to do so.

16th July.—In spite of all ailments we started and worried along, and they in great part disappeared in the course of the day; but instead of trying to see how much heat could be endured I tried to see how much needless exposure could be avoided, and sat bareheaded in the shade of an umbrella, a thing that had been made use of while travelling by boat and sketching in raining weather.

In a mile and a half we came to low hills close to the river, and the rest of the day commonly had them so on one side or the other of the river, but not at the same time on both. Near the river they rose to a hundred feet or 150 feet or so in height, further back to 300 feet or so. We had passed through the plain of the upper Ishcari in 28 miles (11 ri) by the river, or 18 miles ($7\frac{1}{4}$ ri) straight, and this may be taken as about the diameter of the plain. Two rocks in place were noticed, but there were some big blocks of metamorphic sand rock. The river was narrower than the day before, and still much broken up into side channels (Makumbets); and the rapids were still more frequent and difficult.

At length we camped towards the end of the afternoon after accomplishing but $8\frac{1}{4}$ miles (3.3 ri) the rapids were so strongly against us.

17th July.—This day we had hills close by us nearly

all the time, especially on the left, commonly 200 to 500 feet high. On the right were very few hills near the river. On the river banks were now and then exposures of rock in place ; some of them a gray crystalline volcanic rock (trachyte ?) apparently level ; some were dark greenish or blackish metamorphic sand rocks or quartzites, with strike north and south and dip 20 to 45 degrees easterly, and further on 20 degrees westerly.

About noon we reached the Antarama brook on our right with a width of some 30 feet and a discharge of perhaps 30 feet a second. Shortly after that we came to (50 ? foot) high cliffs of light-gray volcanic rock in the hills near on our left, the first of many such cliffs that we saw almost daily until we reached the Tokachi valley. Ishcaridake is with little doubt an old volcano, and very likely Tokachidake too, and perhaps others of the neighbouring mountains. At any rate they seem to be surrounded by thick layers (at least 200 feet in some cases) of light gray or buff volcanic rocks still level bedded or very nearly so ; and the two mountains have also the appearance of old volcanoes from their form. The underlying metamorphic quartzites seem to be less frequently exposed the nearer those mountains are approached.

The river grows more and more rapid and difficult and is still somewhat broken up into small channels by Makumbets. We made therefore but seven miles and three quarters (3.1 ri) by the sketch.

18th July.—We had gone, but a mile and a-quarter ($\frac{1}{2}$ ri) this day through a flat country with light woods when we reached the Rubeshibe, a stream on our left, some fifty feet wide with a discharge of perhaps 125 feet a second. The Rubeshibe was Captain Bridgeford's farthest last year ; and above this only one of our Ainos had ever been. He had gone to the falls of the Ishcari

with Mr. Takabatake in 1872; but seemed to have a very imperfect recollection of the route and distances. By Matsura's map (of 1860), who had also gone to the "falls," we thought it could be hardly a day's journey more to this wonder of the world. So we struggled along against the rapids which grew worse and worse, and threaded our way through the Makumbets (which however, were becoming rather less numerous); and by working until half past six went in the day eight miles and a quarter (3.3 ri) or seven miles from the Rubeshibe.

The hills were rather less frequent than the day before and of about the same height. In the afternoon we had a near but hazy view of Tokachidake, very high before us. The nearer hills were perhaps five hundred feet high, chiefly seen on our left. There were a number of exposures of dark or blackish quartzites (one of them shaly and full of specks of iron pyrites) in place, with dips of 20 degrees to 15 degrees westerly, and one near the end of the day of 50 degrees easterly.

This afternoon we met with a Rhododendron in bloom, just like our American plant, the deer-tongue laurel, except perhaps shorter leaves. There were, however, no thickets of it, only single plants. We were here probably some 1,500 feet above the sea, and nearly a degree of latitude north of Sapporo, and fully two north of Hakodate; yet this plant seemed to thrive and abound although it is rare in America north of Pennsylvania. We found it often afterwards until we had gone far into the Tokachi valley. The woods through the day were as usual light, and there were no prairies.

Sunday, 19th July.—Soon after starting in the morning we had our first view of Ishcaridake since we had left the neighborhood of the Chubets; and soon saw Tokachidake again.

We pushed on in spite of the worse and worse rapids,

and of the dispiriting information from our Aino guide that we could not reach the falls to-day. But as he had said the night before last that it was only half-a-day's journey distant, we put no great faith in him. Indeed I began to suspect that there were no falls at all as we had gone far past the place for them according to Matsura's map. The falls are not given there but two hot springs are given, and they were said to be close to the falls. We struggled on against the almost constant rapids for two miles and three quarters (1.1 ri) until noon. We had passed high cliffs of light-gray volcanic rock on our left near the river and just before noon one of a hundred feet or so in height close to the river on our right.

We stopped to lunch at a pebbly beach near the mouth of a small stream on our right, which by Matsura's map should be the Hombeushi. During luncheon time the Ainos declared that it was impossible to take the loaded boats further, and the guide said that Mr. Takabatake left the canoe loads here and went on a little further with a light canoe and then on foot to the falls, still at a great distance, too far to reach to-day. This information was brought to me where at a modest distance I was drying my outer and under clothes in the hot sun; for just before landing we had shipped a heavy sea in a boisterous rapid, and although I was sitting by way of precaution on a rubber blanket that covered my small satchels with the spyglass, barometers and other hand instruments, and though I was covered with a rubber coat, the mass of water came in and filled the blanket to a depth of two or three inches in which I had to sit some time. The day before, one of the other boats carrying rice had been flooded. Such are the accidents of navigation here; but we were comparatively fortunate, for some of our predecessors had had boats upset, it was said.

The choice was given to our Ainos to go ahead at once on foot or in the boats; and after a lengthy powwow they chose to go on foot. The boats were unloaded at a better place a couple of hundred yards down stream on the other side, and were drawn ashore into the bushes; and preparations for the march were begun. But some of the luggage was to be taken back from here in the boats to Sapporo; my outer tent, for example, and several other things; and it was necessary to dry them thoroughly first and then pack them in birch bark to keep them dry. So we concluded to pitch our camp for the night. Afterwards as we had had no day of rest I decided to stay over Monday, and everything could be well dried, and some of the Ainos could go on to spy out the land towards the falls and make, or at least blaze, a road.

20th July.—A party of Ainos with the coolie interpreter started off early in the morning and came back about sunset. They reported that they had gone to the hot-springs and to the so-called waterfall close by them, about four ri distant from camp, they thought; also that there was after all no genuine water-fall, cataract, but something stronger than a mere rapid, probably a cascade; but it was their opinion that we could not get beyond. Visions then arose of a narrow canyon with immensely high vertical walls of these volcanic rocks, a country in fact like that of the Colorado river. Projects for circumventing the obstacle floated through the mind, such as going up side valleys to the tops of the cliffs, marching along the dividing ridges as long as thirst would permit and other plans; but it began for the first time to seem really possible that we might have to turn back after all our efforts and take the Chubets route as the Ainos had advised. It was said we had fifteen days' food with us, eighteen bags of rice; though I could find but sixteen the next morning, the rest were

said to be at the Aino camp a hundred yards off. We had expected to carry twenty-five days' food on leaving the boats, but found we had load enough for the men; for in the first estimate something had, it seemed, been forgotten, probably the Ainos' own baggage, what with deerskins, smoked fish and other things quite a respectable item. Other supplies of rice had been left behind they said at the Aino house opposite our first camp above the Chubets, some two or three days distant. We could go, then, but six days forward without having to turn back in case of not succeeding. Such thoughts we had to dream on.

The day had in great part been spent by me in writing to my instrument-maker a detailed account of a radically new surveying instrument that had been running in my head for some days and had finally come into definite shape; and that will perhaps now be manufactured in time for my Kaitakushi work of next summer. Towards night my outer tent, well dried in the sun, was carefully packed, together with the iron tent-pins, my thick quilt used in place of a mattress and a small under-pillow; likewise a box of mineral specimens and some other things that it was not necessary to carry on the back over the mountains. The bamboo tent-poles, too, were heavy, and on trial it was found that poles cut day by day in the woods could be used very well without tearing the tents.

21st July.—After a little delay every Aino had his load, and that a heavy one, on his back and off we started by the path that had been blazed the day before. And comparatively easy walking it was too, sometimes through open woods without much bamboo, sometimes along the pebbly shore of the river. I had hung the open leather case of my field glass on my breast and placed in it a small compass hung on gimbals, so that I had merely to lower my eye in order to see our

compass course and was therefore able to conjecture from time to time what the general course had been. The compass, however, was not quite satisfactory, because I had had to replace the original needle and compass card that were out of order by a small pocket compass set loosely into the cup that hung on gimbals. In addition I counted my steps (with a pebble transferred from one pocket to another for every hundred steps and another pebble to another pocket for every thousand steps, eighteen small pebbles in all; my pedometer had been left behind because it had proved untrustworthy) without, however, trying to make the steps of any special length nor to walk in a straight line; to have done so would have caused far too great delay. I estimated the average length of the steps on rough ground when reduced to a straight line to be commonly two feet; and so with the estimated general course from point to point have contrived to make a very rough map to bridge the gap between the slightly better mapped boat journeys.

About once in two thousand steps the Ainos would stop to rest, and it seemed to a greenhorn astonishing that they could carry such loads even so far as that. For my part with my satchel and compass and everlasting counting and the rough road the resting places seemed quite far enough apart without any load on my back; even though I regularly walk five to eight or even ten miles daily at Yedo without feeling the least fatigue. No less was I rejoiced when the hour of noon arrived and we stopped to eat our lunch by the riverside. Not long after lunch the hot springs were reached, about half past two, and the falls just beyond. In spite of all our incredible exertions and fatigue the distance still lacked a thousand steps of two ri, was in fact $4\frac{2}{3}$ miles (1.85 ri); so much for all our pains.

Soon after starting we had a good sight again of the

top of Ishcaridake, the last we should have for some time, the near hills and woods so hide it. We passed some cliffs of volcanic rocks a hundred (?) feet high on the opposite, southerly bank of the river; but still no sign of the thoroughly impracticable region of canyons.

Leaving the hot springs to be revisited from the camp, although the Ainos stopped at them with great interest, we hastened on to look at the far famed falls and to have the camp pitched among the rocks close by them. We found the last account of the falls pretty correct though it had been rather vague. The water rushes rapidly down a steep channel much encumbered with rocks, and is more violent than a mere rapid though there is nowhere a cataract, hardly even a cascade. The interpreter at my request levelled from the bottom, a short distance above the hot springs (although there is a long less violent rapid below that), to the top and found the whole fall to be 47½ feet in a distance of about 260 yards (130 ken), in which space the river sweeps round in a curve of nearly half a circle with the hot springs in the hollow of the curve, on the northern side of the river. This, then, was the upshot of the statement on a map said to be by Mr. Takabatake that the falls were 2000 feet high, and of the story told last year after his visit that they were one ri in height!

On our side of the river was a high precipice to the water's edge, which had given the impression of its not being possible to go further. But almost a glance was enough to see three ways by which we could advance: 1st, we could either climb over the wall of the precipice, not extremely difficult; or, 2nd, we could go a little below the hot spring and ford and then go up the other side of the river without precipice or obstacle; or, 3rd, we could make a bridge of logs across from one large rock or group of rocks in the river to another and so from shore to shore,

This last plan pleased Mr. Akiyama also, and when the camp had been pitched he collected a large number of Ainos and set about the work. On our side was a great deal of drift-wood, some pieces large logs. He had a small stick of timber put across at the water's surface to the nearest rock and immediately crossed on it himself to the rock. I went to see the springs and on coming back found he had got logs laid across from rock to rock as far as to the last one short of the other side by a wide gap of about thirty-five feet. He soon, however, had a long slender stick laid across here, but it sank to the surface of the river or just below, and the volume of water here was great and the current tremendous. He told some of the Ainos to cross in the stream by holding to this log; they hesitated a moment; he with a cry of impatience began to strip off his own few remaining clothes; and then for shame an Aino crossed, and after that another. After that Mr. Akiyama followed himself, but it seemed as if he must be carried down stream. Then one or two more Ainos followed. They sent for an axe and the saw, which were taken across the last gap by a rope. They hunted about in a grove there and found a stick long enough and not too heavy for them to manage, and after much trouble got it to the shore and let one end float round from up stream until it was caught by the Ainos on the rock and laid in place. But it was so slender it sagged into the water as the other had done. By Mr. Akiyama's order, however, plenty of Ainos now crossed on the two sticks and after a time they got down two stouter logs one after another and laid them across side by side above water level. Then they crossed from the shore to the rock, Mr. Akiyama as usual the first, and put supporting sticks for the middle of the logs to stop the vibrations a little; and the bridge was done before night. Indeed Mr. Akiyama quite distinguished himself by his activity,

intrepidity, judgment and control of the men; and, as I said in a former letter, deserved promotion in the field at once if that had been in my power.

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The hot springs proved to be very feeble ones about 25 yards apart and some 200 yards below the falls. The temperature was in one 47 degrees Centigrade, in the other 45 degrees C. The water seems to be impregnated with iron, as the ground it flows over has become covered with iron rust. Some ten yards above them is a still smaller cold spring that leaves a very small deposit apparently of sulphur. The springs on the whole are among the least important I have seen in Yesso, and hardly deserve each the two big characters given them on Matsura's map.

The high cliff at the falls was not of volcanic rock but of metamorphosed quartzite without any clear dip. On the first rock of the bridge the Ainos found many small specks of iron pyrites, in color like gold, and probably such may be found on shore; for a beautiful specimen of pyrites was shown me last summer that was said to come from here, and Mr. Takabatake, I believe, brought back a story that there was a gold mine here, and left a jocular inscription somewhat to that effect.

The travelling time taken in coming to the falls from Sapporo, subtracting the time spent in excursions up the branch rivers, was thirteen days; to the head of canoe navigation twelve days; to the Rubeshibe eleven days; to the Aibets nine days; of course, returning down stream would be quicker. You see, then, how incorrect was the official statement made to me last year at Sapporo that it would take three months to make the trip up the Ishcari and return; three weeks would have been more exact.

22nd July.—It is proverbial in America that nothing

is easier than falling off a log, and I was so fully impressed with that fact in consideration of the wet slippery character of some of the logs of the bridge and of the smallness of some, especially the first ones, four or five inches in diameter, and close to the tearing water or in it, in consideration, too, of an easily turned head and inexperience, that I was not content with going barefoot, but must needs have a rope stretched across as a hand-rail from rock to rock and held by strong Ainos at either end (one of whom owing to a misunderstanding offered at first to carry me across on his back!) With such ignominious aid the crossing was easy enough; but the others, even the cook, scorned like assistance, and the Ainos walked or ran back and forth as if on a smooth, broad floor, perfectly at home.

Less than a quarter of a mile above the falls in a favorable place I made a rough measurement of the river, and found it about 90 feet wide with a depth at most of six feet and a surface velocity at most of four feet and a half in a second; giving a discharge of about 972 cubic feet a second, or adding two small brooks we had passed above the falls one on either side, in round numbers 1,000 cubic feet of discharge in a second at the falls. That would give with the fall of 47½ feet about 4,300 horse-power, allowing 20 per cent. for imperfection of machinery. A dam would scarcely be needed; for the water might be taken from the top of the fall and carried by canals to the sufficiently flat and wide land close below on either side of the river.

Meanwhile most of the Ainos had forded the river, and in attempting to follow, my boots filled with water at the top, and some who had not crossed signalled to climb over a hillside on our right. We had hardly done so, with a little trouble, when Mr. Akiyama pointed out some hot springs he had found there, a quarter of a mile above

the falls, at the river's edge, and some others more difficult to reach a few yards lower down stream. Though not very large springs they were much more so than those below the falls. About a hundred yards further up stream we found two or three more such springs somewhat larger. We had no thermometer with us, but by the hand the temperature was estimated at 80 degrees C., much hotter at any rate than the springs below the falls. There seemed to be little or no mineral matter in the water, no deposit of iron rust, sulphur, silica or lime. I have named the two groups of springs above the falls Akiyama Hot Springs, Upper and Lower, for Mr. Y. Akiyama. For there is no tradition even that any one had ever passed above the falls, and we were therefore the discoverers of new land and entitled to give names to our discoveries. Though the field for discovery was not very large it was doubtless much the largest in Hokkaido, for the Ainos go almost everywhere and give names to all the streams and places. Indeed there are not many large regions of the world where names could be given by explorers, if the native names were respected, instead of every nation's saddling its own set of names on a country, as has happened around Japan. The same fact of novelty added zest to our work, and we felt as we rounded every corner that we looked on a scene that had never for a hundred years at least been before the eyes of man. Who knew but we should discover a little paradise up here like the one above Kamoikotan?

Some seventy yards above the upper Hot Spring we passed on our right a brook with a discharge of twenty cubic feet a second or more, and with its stones all reddened with iron; and I have named this Akiyamagawa, also for Mr. Y. Akiyama. About a mile and a-half above the falls we passed another brook on the right with a discharge of twenty feet or more a second, and with two

mouths. I named this stream for the interpreter of our party.

The hills were close to the river on either side, but we managed commonly to get along near the river's edge without much climbing or wading. Still it was very rough walking indeed, and in spite of all efforts to go at least eight thousand steps (3 miles) before lunch, I sank down exhausted on an inviting rock sixty-five steps short of the goal, and most of the rest had already stopped to eat, although it was not quite twelve. After lunch and a nap and all the Ainos had passed, I followed in their beaten track, and had hardly gone a hundred steps when I found all were fording in a very difficult place, as our road was cut off by a cliff some 200 feet high of volcanic rock. The water was so deep that it was necessary to strip off foreign clothes, and the current so swift that several of us had to hold the hand of an Aino in crossing, and two Ainos were assigned to me. Some of the servants and coolies in ambitiously trying to cross without help were nearly swept away before help reached them.

We had dressed, and had walked on less than a mile when another cliff of volcanic rock some sixty feet high prevented our going further without crossing; and a like cliff on the other side, though it left space to clamber along, partly wading, for a quarter of a mile, compelled you to cross again before the upper end of the gorge was reached, some five hundred yards in all. So here I had to strip again, and though the current was less violent had to be led across by an Aino; then to go up to the upper crossing, cross again with help in a swift current, and then clamber and wade along the foot of the cliff to the upper end. For such work Japanese straw sandals were given me to bind on the foot, and they were a great protection against injury from the stones and against

slipping. To stem the current also we all used a long staff cut in the woods. Although the place was so troublesome it is a fine one to see, and will no doubt be much visited when the valley shall be opened up by a road very easy to make; it is in fact the most striking feature of the valley that we discovered. I have therefore taken the liberty to give your name to it and to call it Capron Canyon. The walls are quite vertical, and rudely columnar; the river makes a bend in passing through the canyon, so that you cannot see from one end of it to the other. Some seventy yards above the gorge a stream of fifty cubic feet or so of discharge in a second came in on our left (north-east), probably the largest branch stream we met with; and I have named that also for you Capron River.

With all this troublesome fording we got on slowly; besides we had at times to pick our way along a rocky, cliffy shore, half in the water, half out, finding with difficulty foothold; and for my part my long boots several times filled with water from the top so that I had to pull them off, empty them and wring out my clothes. Sometimes to avoid fording some of us would climb a steep hillside. With all these delays and difficulties it was five o'clock, theoretically our regular camping time, when we reached a little flat ground on the southwest side of the river, and pitched our camp, for my part quite exhausted, although it was but five miles (2 ri) that we had come in the whole day. The river was so broad and shallow at the camp that a tall Aino carried me across on his back.

In the afternoon we had a small thunder-shower, the only rain we had through the whole foot journey. The woods all day were light, and the valley very narrow; even at the camp the flat was hardly twenty yards wide. The cliffs of volcanic rock had grown lower and lower

and opposite the camp was one but about twenty feet high.

Here and there through the day we still met with exposures of the dark or blackish quartzites that underlie the volcanic rocks ; and one such exposure was at the upper end of Capron Canyon.

23rd July.—Henceforth the big Aino, having in the evening fished for information and found that there was a prospect of special remuneration, was very zealous in helping me on his back across the river, which had now become more practicable ; and I consequently could go dry shod.

We had gone about a ri this morning when we passed (they told me afterwards) the mouth of a stream on our right which had a course nearly parallel but opposite to that of the main river ; and the Ainos call such a stream, that forms as it were the barb of a hook with the main river, Horika, and our Ainos for example called this Horikaishcari. As there is such a name on Matsura's map, probably taken from the older map he copied of about a hundred years ago, it is likely that the valley had been somewhat explored above the falls before that time, at least by Ainos. Our Upper Ishcari Ainos who had last winter crossed in the snow by the Chubets to the Tokachi River, wished to turn off and go up the Horikaishcari, insisting that our proper road led that way. The idea was absurd according to what information we then had, and still seems so ; but it is possible that my Japanese companions would not have had firmness enough to resist the advice ; at any rate one of them thought it worth while to mention the matter as it might possibly affect our plans. It is interesting, however, as showing how little dependence after all can be placed on the so called "sense of direction" of the Ainos.

Three-quarters of a mile further on, we came to a stream on our right with a discharge of twenty cubic

feet or more a second ; and I have named it Araigawa in honor of Mr. I. Arai of the Kaitakushi. The Ishcari Ainos here again wished to turn off and go up this stream as was mentioned to me at the time by the other of my Japanese assistants.

The walking was much easier to-day, commonly over level ground with sand or small pebbles instead of the big blocks of the day before. The fording was far easier, but very frequent and in one case quite deep, so that to go dry it was necessary to sit on the Aino's shoulders. We camped well tired at the end of 6¼ miles (2½ ri.)

The cliffs were less frequent and lower, but once a hundred feet or so high, gray volcanic rock ; there were a few exposures of the dark quartzites ; the valley was rather wider with a few level flats of a quarter of a mile or so in width ; and the woods were everywhere light except a few good-sized firs. But still we did not find the little paradise. The sky was cloudy all day and the mosquitoes terrible ; a thorough dog-day. Our course through the morning was south as for some days past ; but afterwards southwest, about at right angles. We had two or three sights at Tokachidake and Ishcaridake in the course of the day.

24th July.—Another dog-day with terrible mosquitoes until 2 o'clock, when a change in the wind brought great relief.

We had gone a mile and a-half when we found a stream on our right with a discharge of thirty cubic feet or more in a second. I have called it Otorigawa in honor of General K. S. Otori, of the Kaitakushi. Our Ainos started off up this stream, as if possessed with an evil spirit, and had gone a couple of hundred yards before they could be recalled and made to return on the other side through thick brush. It turned out that they supposed it our best road to the Tokachi.

At the end of about three miles (1.7 ri) from camp we came to another stream on our right with a discharge of twenty-five cubic feet or more in a second; and I have named it Yamauchigawa, in honor of Mr. R. Yamauchi, of the Kaitakushi.

At six miles (2.4 ri), we passed on our right again a stream of forty cubic feet or more of discharge in a second; and I have called it Nishimuragawa, in honor of Mr. Nishimura, of the Kaitakushi. The Ainos here again wished to turn off to the right, westward.

The walking to-day was still easier, the fording easier too, as the river was smaller and smaller, and at length even my boots defied it; so that by 4 o'clock, we had gone six miles and a half (2.6 ri). We were delighted to find the river here divided into two nearly equal forks, and as the one on our left seemed to lead most directly to the Tokachi, before starting up it, we pitched our camp for the night at the forks. On measuring the two forks roughly and estimating the velocity, our left hand (eastern) one proved to have a discharge of about 39½ cubic feet a second, the other (western) 52½ cubic feet and therefore this was the main stream. As these figures are more than I had guessed it is probable that the other estimates of the streams newly named were too low. The smaller one of the two I called Kaitakugawa, in honor of the Kaitakushi, and in hopes at the time that it would be "opened up" by a road to the Tokachi valley.

A good deal of heavy fir timber was passed in the day, but the rest was light. We met with strawberries just ripening, as we had also the day before. They had flavor enough but were very sour. We saw too the Rhododendron in bloom this day and the day before, as well as for some days past. We were at the forks some 3000 feet above the sea, and in the course of the day had risen (by aneroid) some 750 feet, and the day before some

500 feet. I read at reaching and leaving every camp three aneroids and my two assistants each one; but the readings of all have not yet been compared. Near the mouth of Yamauchigawa I took a vertical angle to the top of Tokachidake (as I supposed) with my prismatic-level-pocket-sextant and found the height to be about 8200 feet above the sea; but that is very rough.

We saw this day (as we had also seen just above the Falls of the Ishcari) tracks like those of a dog, but much larger said to be those of the Oinu (Great Dog) or Yamainu (Mountain Dog), a wolf, said to be a huge beast twice as tall as the wolf of Nippon and to attack even a horse. Tracks of bears were pretty frequent; deer tracks still more so, but much less so than on the lower Ishcari waters. Two of the Ishcari Ainos were so foot-sore that it was arranged they should stay behind here with ten days rice for them.

25th July.—The valley of the Kaitakugawa seemed very level and open while the valley of the main Ishcari seemed to be much shut in with mountains. So we set out in the early morning very hopeful of finding a low pass. The stream was now so small and soon so much smaller that my ferryman's special occupation was quickly gone.

We had hardly walked a thousand steps when we came on our left to a brook of perhaps fifteen cubic feet of discharge in a second, which left our main stream so much smaller than before that we had renewed hopes of reaching the source the same day.

For the first ri the road was rather easy and flat, with 50 foot, 100 foot and 300 foot hills near by on either side, and with heavy fir timber all about us. About the end of the ri we came to exposures of the blackish quartzites again (with dip of 30 degrees westerly), and they were hereafter frequent; and no more volcanic rocks were

seen until we had descended into the Tokachi valley; we had got above the level of the volcanic beds. About here we found a patch of snow some five yards in diameter and a foot thick; some 4200 above the sea. After a little rest and refreshment at the snow bank we pushed on, now eastward instead of south-eastward, up the valley which had become so narrow that we had commonly to walk in the brook, and this had begun to be rather rapid in its fall. A thousand steps beyond the first ri brought us to a waterfall of twenty feet in height which there was a little trouble in climbing round by the steep rocky hillside. The dip of the rock had become sixty degrees, but was still westerly, and it continued westerly till we had crossed the mountain.

At less than eight thousand steps we stopped to lunch, about four thousand and five hundred feet above the sea; and the road was getting a little difficult, though with easy bits here and there. Though the valley was so narrow it still seemed rather open before us, as if there were a low pass. The trees had dwindled to mere brush, chiefly birch. We had come upon strange flowers of quite a northern and American look, and even the Ainos were interested in the change and stuck some of the flowers upon their load, besides calling the botanical collector's attention to them. The most striking new flower perhaps was a magnificent buttercup with flowers two inches and a half (0.2 feet) broad; and the common small buttercup grew alongside. The interpreter had his tin box crammed to overflowing with botanical specimens before we reached the top of the mountain. Indeed his collections of these high mountain plants, the first ever made in Yesso, will undoubtedly be of the greatest scientific interest and will be quoted throughout the botanical world.

At nine thousand steps the stream forked and we went up to the left, although the other fork was nearly as large,

The stream now became rapidly smaller and smaller, losing here and there a side rill; and our path grew steeper and the trees lower and lower, until hardly anything but a dwarf five-leaved pine was left, and that only a foot or two high, but very widely spreading. The absence of trees however gave us the better view, but the valley was too narrow to see much downwards, though we had views of Ishcaridake (as we took it to be). At length some of us had passed the little spring that was the source of the brook, and were climbing by the steep mountain side hoping soon to have a view at least of the pass, when there came a great calling and shouting and talking on the part of the Ainos below and around us. Then a shout from them for Mr. Akiyama to bring some medicine as an accident had happened; but he had eagerly gone on still further in advance. At length the Ainos answered me in Japanese that one of the Ainos below had met with an accident, apparently a serious one, probably an arm broken. The interpreter who had been close behind me had already started downward; and I turned back too with great regret at having to descend so far when so near the summit, but with the belief that even my very limited surgical knowledge and experience was far superior to that of the others. On reaching the wounded man it turned out that a loosened stone, large and sharp, had fallen from above and cut a bad gash perhaps an inch and a half in length, in the corner of his forehead close to the temple. My interpreter and the coolie interpreter were with him and one or two Ainos near, the rest had gone on. Some green leaves had been put on the wound, and paper tied over it; and the man seem either in great pain or almost faint or frightened or interested in receiving so much attention. I happened to have some court-plaister in my pocket, and to have had the experience on the lower St. Lawrence of putting plaister on a similar wound in the forehead (from the swinging

of the boom of a sail) under instructions from the experienced sufferer. So I cut the plaister in narrow strips and laid them cross-wise of the gash. It was arranged that the patient should come on with frequent rests, and that somebody else should carry his load. As we had been eating more than a bagful of rice (a man's load) a day we were less heavily loaded than at first. On getting nearly back to the point I had reached before, I met Mr. Akiyama coming down with a brilliant scarf in his hand, which through the rest of the trip the wounded Aino wore around his head apparently with pride. A single inch of difference in the course of the stone towards the temple would undoubtedly have ended the man's life.

Up and up we went, steeper and steeper, following still for a time the dry bed of the narrow rivulet. Then we turned off to the right a couple of hundred yards and soon after three o'clock about four miles (1,6 ri) from the camp of the morning reached the lowest point in the summit of the mountain, the Kaitakutoge (or pass), about six thousand feet above the sea. Here we had a view of the valley to the east, and it seemed to correspond well enough in appearance with what we had expected from the map. A small stream lay before us running a little south of east though a nearly flat country ; at some distance, before reaching a north and south mountain range it seemed to join a larger stream running southerly and afterwards perhaps turning south-easterly as we expected from the map. Near the turn, behind a mountain, we expected to find the Aino village Kuttarushi, where boats and food should be waiting for us. All but the flat valley before us was a confused mass of mountains, especially southwards, many of them sharp peaks. The distance was hazy and we could not see the sea as we had hoped to do. Every where were green woods; two or three white cliffs in the distance could be seen

near the river; but nowhere any smoke or trace of an Aino habitation.

Looking westward we had a view of the snow patched top of Ishcaridake and also of Chubetsdake (perhaps), and took a rough vertical angle with my pocket sextant to get the height as we had done lower down. The result is a height of about 7700 feet above the sea for Ishcaridake, and that is perhaps correct within a couple of hundred feet; but the distance, on which the calculation of the height above the barometer reading depends, is very uncertain. Ishcaridake is much broader and larger than Tokachidake and has a much greater amount of snow, but seems by our measurements to be some five hundred feet lower.

Near at hand on the west the mountain side looked very bare, for even the pine had dwindled to hardly half a foot in height and was found only in patches. At a distance of half a mile to the southwest the keen eyes of the Ainos spied a large bear walking leisurely about, but he was far from seeking our society when he perceived us. On the east the mountain was extremely precipitous, and close before us was a narrow very steep gully filled with a patch of snow a dozen feet wide from the top to some one hundred yards down, where the gully turned and the end of the snow was hidden.

The Ishcari Ainos were asked rather triumphantly if they did not now recognize the Tokachi valley; on the contrary they pointed to the southwest and said the mountains there were those near the Tokachi valley! It required confidence in maps and geography to withstand such persistence as theirs.

When all had arrived at the mountain top, even the wounded Aino with his brilliant bandage, the question was how to get down on the side. Some of the Ainos were for clambering down the steep, rocky, cliffy side of

the mountain ; but I advocated going down by the snow ; a plan which did not meet with much favor. Still to show its feasibility I started down that way myself, poor mountaineer as I am, and with the help of my umbrella and a blunt, light level rod they handed down to me and of my boot heels I descended gradually without sliding at once to the bottom. Getting on one edge of the snow it was a little easier going, half on the rock or earth, half on the snow. When I had got something like half-way down the visible part of the snow, they shouted from above that a better path had been found, and that as it led in a different direction it would be hard for us to meet below this night, if I did not join them. So, much worn already with fatigue, I had to climb back again, but was helped by my strong Aino who let down a rope to me and pulled me up from place to place. Then we went some three hundred yards southward along the mountain ridge, rising a hundred feet, and after refreshing ourselves at another snow bank began to descend about five o'clock. For some 700 feet down, the mountain side was all open, and, though very steep, not at all impracticable. We zigzagged along down sometimes clinging to the grass or to a small bush. Near the bottom of this space one of the willow boxes fell and rolled down a long distance, but was recovered much broken. The Aino had probably had to part with it in order to save himself from rolling down too. At the bottom of the 700 feet was a small rather flat spot where we rested, although it was getting so late and the foot of the mountain was so distant. Just there we came to a grove of small (yellow?) birches. To our right, southward, was seen a large valley, which proved to be probably a branch of the one we were descending, and which seemed to lead to a lower pass near the head of the main Ishcari, but we could not see far enough in that direction to decide this point. However if there be a lower pass

there, we probably had not had food enough to go that way, as it would have been at least a day or two longer.

In the grove, we wound round a nose of the mountain and descended pretty rapidly. Within fifty feet of level we came to small bamboo about two feet high to which we could cling. At length some of our Ainos told us as we passed that some of the others had found water just beyond, and we pressed on eagerly for it; but it proved a falsehood, and we were pointed to a place a little further on. The interpreter and an Aino got some distance in advance, and after a long silence answered the shouts of the others, but said the way they had come was bad. So the Ainos with us went further along towards the ridge of the nose, and one group after another tried going down more directly; and so we got scattered. Mr. Akiyama was far behind urging on the rearward Ainos, who were as usual the Ishcari Ainos, decidedly inferior to the Chitose and Shiraoi Ainos with us. After going down a little we came to precipices fifteen or twenty feet high, which the interpreter somehow had managed to descend; but which we, especially the loaded Ainos, must go round. I found at length a small ravine that led past the precipices, and gave welcome drinking water too, and one after another four or five Ainos and my servants joined the interpreter and me at the mouth of my little ravine, on a small brook. The cook was said to have fallen down a precipice "four ken" (24 feet) high; but he had no broken bones. We walked down the steep brook a couple of hundred yards and came to a waterfall a dozen feet in height. The Ainos explored a little and found a way to get down to the brook below, by using care and clinging to the weeds. It was then about 8 o'clock and beginning to grow dark; so, almost exhausted with fatigue, I was glad to consent in view of the difficulty of following down so precipitous a valley in the dark to

bivouac here, perhaps about five miles (2 ri) from the morning's camp. Not only my servants but my food and blankets were with us, and one tent. The ravine was too narrow to pitch the tent, but the four Japanese including the interpreter, slept together under the tent as a coverlet; while a separate bed was given me and the Ainos even undertook to spread some oil paper we had on a framework of sticks over my head. Of course we slept in our clothes and for my part very comfortably, except that my wet feet were rather cold even in my boots. As for food, hunger is the best sauce, and the cook, under specially unfavorable circumstances, seemed therefore to succeed better than usual.

26th July, Sunday.—Of course we had not been unmindful of our companions, and wondered where they might be; but going in search of them had been impossible. Early in the morning an Aino came up our brook to us (in answer to a shout from our Ainos); and it turned out that he and two others had bivouacked without food some 300 yards lower down; and that there were two or three waterfalls in that distance. After breakfast we followed his guidance, and kept on further down. We came to a high waterfall and had to make a long difficult détour to the left, and, just before we had got to the brook again, the willow box of the Aino who was leading us rolled down the steep hill. He bounded after it as if he were on a level plain. At the end of a quarter of a mile we found Mr. Akiyama and some Ainos on a small, nearly level spot where they had just arrived. He had kept the men moving until ten o'clock at night, but contrary to his judgment they had taken a bad course; at length they had to bivouac on the steep mountain side without water and no food but poor rice. Yet even with them the excellent sauce of hunger made the food taste

good. Other Ainos who had been with him through the night were now coming in, and we stopped for some two hours while food was cooked and eaten.

Thereafter the way was much easier and at the end of another quarter of a mile we came on our right to a much larger brook of perhaps 30 cubic feet of discharge in a second, probably from the valley we had seen to the south the evening before. Here also was the beginning of a large plain or nearly level ground ; we were fairly down from the mountain. Following down the rapidly growing brook, still in an easterly direction, we found it at the end of half a mile or so to have a discharge of perhaps 90 cubic feet a second and to be joined there by a stream from the north-west of perhaps 60 cubic feet of discharge in a second. It was noon by the time all without exception had arrived here, and on account of their great fatigue the Ainos begged to rest until the next day. So the camp was pitched after a journey of about a mile (15 cho).

We had now come down to a level of about 3000 feet above the sea, about the level of the mouth of Yamauchigawa. The woods were everywhere pretty thick and of pretty large size, chiefly fir, but a good deal of smaller hardwood.

In descending in the morning we had seen several exposures of dark quartzites with a dip of 60 or 70 degrees easterly, the opposite direction to the dips of yesterday, showing that the mountain ridge is formed by a rock saddle or anticlinal.

27th July.—We were well rested in the morning and and started off promptly, with loads much lightened by the six day's rice that had been eaten. In fact the Ainos raced along at a most astonishing rate compared with what they had done on the Ishcari. Instead of stopping every third of a ri or less to rest they would go a whole

ri at a time. The valley was flat near the river, but a short distance back were bluffs of some 20 feet in height at first, afterwards fifty feet or so, above which it was flat again. The country was all wooded and with small bamboo under the trees. We could often therefore go for a long distance on land without fording, sometimes by a deer path (for traces of deer were much more common here than on the Ishcari above the Falls). Now and then, however, we had to ford, and later in the day still oftener on account of cliffs along the shore; and at such times my Aino ferryman was a great help. He would also sometimes lead me over the flat topped hills to avoid fording. Coming down such a hill in the afternoon to cross a brook we saw a small tree that had been cut with an Aino knife, and soon after found the remains of an old Aino camp; the first signs of human existence we had met for many days. At length after racing along in this way through the day we encamped on the left bank of the river at the end of ten miles (4 ri), a day's journey that seemed marvellous in comparison with what we had hitherto done.

Our general course had been southeast, more easterly at first, afterwards more southerly. The stream had gradually become quite a large one with a discharge of perhaps three hundred cubic feet in a second. In spite of their heavy loads, on dropping them to rest the Ainos are always active to strip off from an ohiyo tree the bark from which their cloth is manufactured, and which they used raw on the journey for making sandals, or rather shoes covering the toes and heel better than the straw sandals; or to hunt for large fishes in favorable portions of the streams. Some throw big stones, if necessary, into the water to make the fishes move about; others are on the look out, often up to their middle in the water, and spear or hook them in the side with a hook of some three inches

in diameter that is tied on the end of a long pole so as to have the sharp point forward. Many trials are made for one success. Of course, in striking, allowance has to be made for the refraction of the water, which makes the fish seem higher than the point at which the hook is aimed. All along the cold clear waters of the Upper Ishcari such attempts were extremely frequent, and large fish (masu), a foot and a half long, were added to the delicacies of the Ainos' repasts. On the Lower Ishcari and its waters venison was a more frequent addition than it was further up, indeed almost a daily one. This day about noon, the Ainos hooked a large fish (a kind of masu) which they said in the Ishcari did not go far from the sea; so that they were already encouraged by the fact. The Ainos also caught many small fish with hook and line, and the servants and coolies early in the journey caught the fever of doing the same. After pitching the camp this evening two or three Ainos in front of my tent caught small fishes almost as fast as the line could be cast. They had also caught many at the last camp. These small fishes seemed to be trout of two kinds; one was called the little masu, but is not the young of the masu they say. One kind was speckled with red dots. Both kinds are about half a foot long or a little more.

We passed in the day many white or light gray or buff cliffs a hundred feet, sometimes even 200 feet high, of soft, rough volcanic rock, level bedded or nearly so, without any trace of columnar structure; in the early part of the day it was a tufa with pebbles of the size of a pea or a little larger.

The timber was generally pretty heavy, especially firs. In the afternoon we passed Rhododendrons in bloom. At night we had come to a level of about 2,400 feet above the sea,

Our course became during the day much more southerly than before, say south-south-easterly.

28th July.—This day the country we passed through, the rocks, and the timber were much the same as the day before; and our speed likewise. We soon passed traces of Ainos' hunting camps and an Aino fishing apparatus like an eelpot. About eleven o'clock the (for once) welcome sound of the barking of Aino dogs was heard a little in advance. It turned out to come from an Aino's house near the river, at the end of nearly four miles (1½ ri), and we stopped for an early lunch (the Ainos seemed fond of lunching very early), while we gathered some information from the man of the house. He told us we were not on the Tokachi river at all, as we had been trying to believe, still less on a northern branch of it, as we had supposed at first; but that we were on the Otopchi a south-western branch of the Tokachi and separated from the branch stream we had aimed at by the main river and by a large parallel branch. Here was an enormous error of at least fifteen miles in Matsura's map; and a thorough confusion of the courses of the rivers. The Aino said our boats had gone up to Kuttarushi, as expected, but that we could not go there across the mountains; that following down the Otopchi we should come to the Tokachi near Satsunaibuto (where there would be boats), four days' journey distant. "Four days!" at the end of seven or eight days, and we had thought to crosss from boats to boats perhaps in five days; could we not by hard work arrive a little sooner? "Oh, yes; in that way it would take but a day and a-half." That was an encouraging change, and we were sure that he had never known such hard work as we habitually did. So we counted on reaching the Tokachi by the next night, and started off at noon. He went with us at once as guide. His chief luggage was a bow and a quiver of arrows; for Ainos still use the bow, although some have matchlock guns.

I was told at the same time that we had only four day's food left, probably by careless measurement twelve days' rice had been eaten in eight. Henceforth the rice was to be strictly measured, and we should have just enough; for from Satsunaibuto it would be but two days by boat to the sea shore. The Otopchi river was so shallow in places that there was not a boat short of the Tokachi. As the Otopchi was wrongly written on the map, and as we had but few words from the Aino through an interpreting Aino, we got the impression that we were in the Satsunai valley quite on the other side of the Tokachi; far to the south. That was confirmed soon by our coming to another Aino house on a brook called Yûunai, a name that we found on the Satsunai, and it seemed quite near to the Tokachi. We went on then in fine spirits. The Aino led us by a good path which cut across the long bends of the river and required little fording. My ferry-man had made his load a light one and induced me at fords to sit on top of it with my legs over his shoulders, so as to save him the trouble of crossing twice. At about three miles (1.2 ri) from the first Aino house we came to some falls or a cascade of the river perhaps twenty-five feet high in a very narrow rocky gorge. We forded below in deep swift water, and soon had to climb high up a mountain side, perhaps four hundred feet, by a rough, steep path. At length much fatigued we reached the river again, and on the way across it pitched our camp on a large island in face of a cliff of light-gray volcanic rock some forty feet high. We had gone about 9½ miles (3,8 ri). On inquiry in the evening of the Aino guide we were disappointed to learn that we had not yet after all gone one third of the way from his house, only about one quarter, and that our loaded men could not reach the Tokachi the next day, though an unloaded man could. It was clear then that

we must go hungry for a while before reaching the sea shore.

29th July.—We crossed the river and leaving it at first some distance on our right passed over the low sides of some hills. At the end of about two miles we came to an Aino house that appeared deserted for the day at least, and right after that came to a large prairie and the brow of a bluff some fifty feet high near the river. The path henceforth was very good though narrow, and almost always in such a prairie, oftenest on the brow of such a bluff. The prairie was not always quite free of trees, but had scattered trees, and often very open grassy groves or small clumps of light oaks. The grass and weeds were not very high, say three feet, perhaps owing to the comparative dryness of the upland, but near the river were smaller prairies with taller grass and weeds, and perhaps fewer trees.

Towards noon we crossed the river, and keeping near it for some time rose to the upland again, and lunched at a large Aino house there. Then we went along again on the brow of the bluff with fine views of a wide plain to the left with scattered trees, and of not very distant high mountains on our right having their southern end nearly opposite to us. Our course at the last fording had become southerly, and after luncheon south-westerly. At length we reached an Aino village of three houses, Surukonai, at a small brook, and we encamped opposite on the high bank, at the end of a day's journey of about thirteen miles (5.2 ri). We were horrified to learn that it would take nearly all the next day to reach Satsunaibuto, that it was seven ri distant, the next day they said eight; but we put no faith in the measurement.

At this camp we were for the first time this season extremely annoyed by a small black fly.

30th July.—The flies were so troublesome in the

morning that we rose soon after daylight, about half past four, and started about half past six. We began by crossing the brook and then the river, and thenceforth continued on that shore in a nearly south slightly west course. Still we walked through prairies or half ópen prairies, and commonly along the brow of bluffs, now and then descending to cross a brook. In the forenoon we passed seven Aino houses and stopped to lunch near the last pair of them, at a small stream under the bluff; where, however, the flies again troubled us too much for any good rest. We had come nearly four *ri*, but scarcely half way to Satsunaibutó, and we almost despaired. Still we pushed on steadily with only occasional rests until at six *ri* or more we came to the top of a (70? foot) high cliff above the river. Soon after, we came down from the bluff into some woods and rested at a brook, and were told it was now but a very short distance to the big river. So we worried along almost dead with fatigue, and soon passed an Aino house where a venerable looking man with a long white beard said something to our guide, but seeing the rest of us following, turned, and entered the house, and left the bamboo curtain hanging before the door. The house then looked as deserted as many we had passed, which were perhaps after all likewise inhabited; for the Ainos in the backwoods, whether from scorn, or fear, or politeness, showed but little curiosity in regard to such strange sights as were passing. Soon after that, we came to a good-sized river, probably the Otopchi, and here I expected to camp having had enough exercise for the day; but they insisted that the distance to the big river was only what we had come from the Aino house, so I moved along. It turned out nearly four times as far; and this was but the last instance of many in which we had been lured on by inexact statements; if we had known the real facts we should

perhaps have despaired sometimes. We finally reached the river (passing on the way another Aino house, the thirteenth we saw on the Otopchi), and I was close behind the guide; but there I dropped on the pebbles of the beach almost dead with fatigue. Satsunaibuto was still half a *ri* further on, but boats could pass where we were, and we went no further. We had come 19½ miles (7—8 *ri*). How the Ainos could carry the loads they did such a distance was a mystery to me.

I did not commonly walk at the head of our column; but generally in the woods walked in the rear and the Japanese along with me; for the feet of fifty men made a comparatively good path where none had been before. It was rather a picturesque sight to see such a long string of men with all manner of different loads and rigging and dress, and almost every degree of undress, moving through the woods or prairies. The servants, coolies and Ainos all carried long staves, sometimes replaced by an Aino bow or by a fishing pole, or a level rod. The Ainos had their burden hung on their back by a broad band across the forehead, often bound upon a rectangular framework of sticks and with cords across the breast. The appearance of your humble correspondent must have been as striking a part of the procession as any. He might be seen with weary look bearing the burden of a satchel crammed full of pocket instruments, maps, note-book and many other things handy for use on the road, also with the compass in the open leather case of the spy-glass hanging on his breast by a strap round his neck and tied by a string round his body. His habiliments were decidedly dilapidated; his head was bare, for a black felt hat had proved quite too hot at the beginning of the foot journey; his hair consequently more or less dishevelled by the limbs of trees that brushed it; and in his hand he carried a foreign umbrella that became gradually more and more

tattered from contact with the stones and bushes, for it was used almost wholly as a cane and seldom opened even in sunshine until we reached the wide prairies of the Otopchi. Indeed since that practice I go for hour after hour bare-headed in the hottest sunshine without special discomfort.

It was not often, however, that we formed one single procession; for there were independent spirits that thought they could improve now and then upon the route chosen by the leader; and even on the Otopchi path, where there was no choice, one man after another would stop on the pretext of tying his sandal and rest a while, and so the party was soon after starting broken up into groups. The stragglers were sometimes more than an hour later in coming into camp at night.

Such a raft of companions, however, a respectable village in themselves, everywhere in sight or in hearing, always took away that impression of solitude that we must have had otherwise on the upper rivers.

We learned at the camp that no practicable boats could be had; but some Aino messengers we had sent in advance had gone six ri up the river to an Aino village where boats could be borrowed, and would probably return by the next noon. I was told that we had three days' food left; by what hocus-pocus I never understood. We had been making great exertions to avoid fasting more than a day or two, and yet there was plenty of food to spare. The overland journey had taken just ten days; and we rejoiced that no serious accident had happened.

The nearly open prairies we passed through on the Otopchi must have averaged at least two miles in width with a length in all of about thirty miles, making an extent of sixty square miles or say forty thousand acres.

At our camp again the little black flies were worse than

ever, and seemed almost as capable of enduring smoke as we were ourselves.

31st July.—The day was chiefly spent, while impatiently waiting for the boats, in fighting with the flies and in vainly trying to rest. It was a sultry dog-day.

In the course of the day the Ainos seemed to recover from their fatigue and grew more noisy. In the evening, one party of them (for they commonly encamped separately according to the place they hailed from) renewed an entertainment they had not for a number of days indulged in. It was the intellectual one of chanting a poem. The chanting is done by one man, while at least two beat time loudly with sticks. Although a very interesting matter and no doubt highly intellectual it has at a little distance a very monotonous sound and becomes then very tedious. Yet it is sometimes kept up until 11 o'clock at night, without, however, preventing the participants from rising as usual at half-past four or five. The Ainos indeed seem to need but little sleep; and the digesting and assimilating powers of their stomach are so good that they require only half as much rice as the Japanese coolies (one half a *sho* instead of a whole one) and that without making up for it by eating more fish or meat. Moreover, several accidental observations of Aino fæces (*nil humanum mihi alienum*) showed them to be always quite small.

1st August.—The morning was mostly spent in the same way as the day before. The twenty Upper Ishcari Ainos and the cooly interpreter were sent back by the road we came. There was rice enough for that, for our Tokachi boats had left some at Satsunaibuto. Some of the Ainos came to say good bye and stroke their beards; particularly the wounded man with his hand laid on his nearly healed wound and with a smile of gratitude on his face; much more than I had thought of expecting. Their interpreter had already had the new

names of the streams and places of the Ishcari headwaters explained to him, and a rough sketch given him, so that the Ainos should know the places by their right names.

There was plenty of rice now, to be sure, but the other articles of food to which my assistants and I were accustomed began to run short. In my case, however, they were pretty satisfactorily replaced by vegetables from the Aino village near by, not vegetables cultivated by the Ainos, for they cultivate nothing in these forest settlements. The forest is their garden and yields them not only meat but vegetables, and throughout they reap where they have not sown. There was in particular a kind of wild lily root that tasted much like the common lily root, but was larger, slightly bitter and mealy, and it made a pretty good substitute for potatoes. Then there were burdock roots and one or two other delicacies. It is a great wonder that my special supplies had in general held out so long, for ten days before the boy had said in apology for the absence of some accustomed article that they had been told in Sapporo to provide for thirty-five days only ; whereas the time really calculated on in Sapporo was seventy-five days, including twenty-five for the foot journey. It took us in fact forty-five days until the arrival of our boats on the Tokachi.

Early in the morning ten of our best Ainos had been sent off on foot up the Tokachi to find the boats and hasten them along. At noon they came back with the boats that had gone up the Tokachi for us and that had been able to go only six ri higher than our camp. From there parties had been sent up several streams with food to look for us, and there had been some delay in getting word to some of these men, some did not reach the sea shore until several days later than we did. With the boats came the Japanese cooly who brought our spare luggage from Sapporo to the Tokachi, and who had had

charge of the Ainos of the Tokachi expedition. He looked so grand that I mistook him for some yakunin. He brought a number of letters.

As soon as we had lunched and read our letters we embarked, and before night went about five miles (2 ri) down stream to Tobetsu-buto, opposite an Aino house. The lower half of that distance was very difficult; the river was much broken up into small channels, and our way led through one that was extremely narrow and shallow, so that the boats had to be hauled one at a time over numerous shallow places, and after a while even had to be unloaded.

It was not until this evening that the real position of the Otopchi river dawned upon me, so firmly rooted had the wrong impression become; and my two assistants were also mystified until I explained it to them at Ohotsunai.

The woods near the river were very light all the afternoon. The country was flat. Our general course was south-easterly.

2nd August, Sunday.—We had been told that by starting very early and working late we could reach the mouth of the river (Ohotsunai) in one day. So we started at a quarter before six; and the Ainos were allowed to stop to rest only at noon (not as they used to on the Ishcari every hour or so for a quarter of an hour). In that way we reached Ohotsunai by half-past four, a distance of 18½ miles (7.3 ri) by my sketching. We found many very gross inaccuracies in Matsura's map; for example, we were surprisod to hear the surf close by when by his map we should have been half a dozen miles or more away.

The general course was south-easterly, but with great bends and many small ones. The country was flat with a few low (100? foot, 40? foot, 15? foot) hills towards

the sea; and there were many large open prairies; the woods were light, commonly mere brush.

About 2½ miles (1 ri) above Ohotsunai we passed a cliff some 50 feet high of nearly level green sandy beds with an irregular bed of lignite some two or three feet thick near the bottom; but it seemed too thin and impure to work. We saw on many pebble beaches bits of such lignite, but nowhere traces of coal. Special search was not only made at noon, but just below the mouth of the Tosbibets, a considerable branch on our left (500 ? cubic feet a second).

In the course of the day we passed no less than about 36 Ainos houses. Indeed this valley seems far more populous than the Ishcari above Sapporo. Many canoes were seen along the shore, and near the water's edge many whittled sticks. In one place 25 of them were so arranged in a row as to show a special regard for the numbers three and nine. Three large sticks were separated from are another by two smaller ones on each side of the middle one, and the row was completed at either end by nine more of the smaller sticks. About a mile and a half above the river's mouth was a small Shinto temple which must be for the use of Ainos.

At last we reached the village of Ohotsunai on the seashore, only a conple of Aino houses and one Japanese dwelling, the honjin, though there are several large store houses and perhaps empty dwellings. It was a great novelty to us to enter a house once more; and the clean honjin seemed most luxurious.

We stayed two days at Ohotsunai and on the second before our twenty-six Ainos started homeward I made some measurements of their bodies and record of their features, although quite inexperienced in such matters and perhaps quite wrong in the choice of parts to measure.

It was surprising to see how many of them were partially or wholly bald, and (though they are reckoned by the Japanese as so very hairy) how many were naturally comparatively free from hair on their faces and bodies. Their shortness too was striking; on the average only five feet and a quarter, varying from 4.80 feet to 5.71 feet; the latter(5 feet 8½ inches) being my gigantic ferryman. Their ages varied from fourteen to forty-one, with an average of twenty-nine; but in most cases they did not know their own age exactly. The fourteen-year-old lad was about full grown, but slender; he did a man's work with great ambition, and in fact seemed older, say seventeen. Even when the loads had become lighter on the Otopchi he must have carried one half of his own weight or more. The average weight of the Ainos (with their light clothing) was 141 lbs., varying from 108 lbs. (the boy) to 183 lbs. (the ferryman). In general, their hair was thick with a tendency to stand out all over the head. The forehead varied from low to high, commonly of middling height; it was always round. Their brows were very overhanging; their eyes commonly of middling size and always black; their cheekbones were rather high; their nose, commonly with a very low bridge and with broad nostrils, was oftenest turned up, but sometimes straight; their mouth, lips and chin, commonly hidden by the beard, seemed to be of middling character, the mouth not very small, the lips, as compared with Europeans, not unusually thick, and the chin not very large, perhaps even rather small. Of three, who had received special compensation and were therefore bound to submit to anything, we took a number of other dimensions. Their average age was twenty-six, height 5.46 feet, and weight 161 lbs. Their heads measured on the average from front to back 0.68 foot; from side to side 0.55 foot; and from chin to crown (or, rather, vertical height) 0.77 foot; from chin to mouth 0.16 foot. The facial angle was taken very imperfectly, but seemed

to be about 65 degrees. The upper arm measured on the average 1.08 foot long; the forearm 0.83 foot; the hand from the wrist bone 0.66 foot; in all from shoulder to finger tips 2.57 feet, a rather unusual length, I believe, for Europeans of their height. The average length of the leg down from the hipbone (taken by mistake instead of the joint) was 3.10 feet or probably the true length of leg 2.70 feet of which 1.14 feet was thigh, and 1.56 feet (measured) foot and leg below the knee. The foot averaged 0.85 feet long by 0.37 feet wide and the heel was always short. The shoulders averaged 1.46 feet in breadth, the neck 0.20 feet in length, the body from shoulders to hip bone 1,60 feet, or to hip joint probably 2.00. But their muscles were the most striking feature from their enormous size. The men seemed one mass of hard muscle, and in feeling for the hip bone I could not perceive it even when they pointed out its place. Around the chest they measured on the average 2.99 feet; around the upper arm 1.04 feet; fore arm 0.97 feet; wrist 0.56 feet; thigh 1.76 feet; calf 1.26 feet; ankle 0.86 feet. A few other measurements were also taken, but probably less important ones.

As to the size of their muscles aud their weight, it may be well to bear in mind that they had just come in from a fatiguing, wearing trip. Perhaps not so to them, but the scales gave my own weight so very low 116 lbs. (20 to 25 lbs. less than my usual weight, and less than I have known for some 25 years), that they seemed certainly very incorrect, until afterwards there came an opportunity to test the matter and they proved quite exact. As my bones had of course not lessened in weight, the wonder is how the remaining muscles managed to drag them over the mountains as well as they did.

I had no opportunity to take the dimensions of any Aino women, although on the way down the Tokachi an

elderly Aino woman along with Aino men of the neighbourhood helped to pull the canoes over the shallow places. In general, however, whenever we met with Aino women in the wilderness, they crouched on the ground, half averted, and covered the lower part of their face, as if almost consciousthat their tattooing round the mouth was a frightful disfigurement. Their shortness of stature was even more striking than the men's, and the features of their face commonly small and delicate, and not seldom well-shaped. Their dress seemed to be the same as that of the men. They are said not to use chop-sticks in eating as the men do, but to eat with a wooden spoon instead, and I have seen some such spoons quite prettily carved. What can be the cause of such a difference of custom, or why the women should be so far in advance of the men in this respect, are matters for speculation. Possibly the use of a spoon with a heavy Aino moustache may have its inconveniences as compared with the use of chopsticks. The men use also a stick shaped somewhat like a small paper cutter, for raising their mustache while drinking wine. Wine-drinking, by the way, is considered their great weakness, and we carried kegs of wine for them, because they will go nowhere without it, as it is said.

Our Ainos submitted very patiently to the measurements contrary to the expectation of my Japanese assistants ; but we began very gradually, and took their height and weight first, about which they had some curiosity themselves ; and we began, too, with those who had been paid extra for other things and could not object. As an encouragement, too, in the midst of the work I showed them some of the so-called Pharaoh's serpent's eggs, which on being burnt produce such a long serpent-like mass of ashes. The Ainos did not seem in the least awed by such a miracle, but were greatly interested and amused, and laughed heartily. They laugh

indeed on all occasions, when they catch a fish, and when they fail, when they catch a fawn in a bushy swamp, when they try in vain to make a water-fly go under the water, when they succeed or fail in their games, in short, whenever there is anything either exciting or interesting as well as amusing.

As for awe or supertitious dread, it seems rather foreign to their nature. Although they set up whittlings for some religious purpose, they seem to attach no great sacredness to them; at any rate the ornamental whittlings put at the end of a canoe were sometimes in joke disarranged by the Ainos of another canoe.

The imperturbable good humor of the Ainos seems a remarkable trait. They were constantly full of practical jokes, spattering water on each other in their canoes and playing all kinds of tricks at one another's expense, and always in the best of humor on both sides. Only once did the teasing go so far as to call forth a serious return, and that was from the fourteen-year-old boy, and he was almost instantly shamed to silence by his comrades.

There seemed to be a great uniformity in the taste and acquirements of the Ainos, far more than in the same number of civilised men, still more of educated men, though all educated in the same school. They seemed to differ chiefly in the amount of bodily strength, and to differ in this respect from each other far less than from other men. Is it perhaps that the weaklings and those that have by nature unusual tastes, die young? or is uniformity in a very limited training necessarily very uniform in its results, and are idiosyncrasies comparatively late in showing themselves in the development of the mind? The embryos of different races of animals are said to resemble each other the more imperfect their development. All the Ainos

seemed equally to understand all the affairs of backwoods life, and whenever they worked together at any thing it was with a common understanding without instructions from one to another and often without words of any kind. They seemed at such times to be governed by a "gregarious instinct," and to co-operate much as bees or ants do without intercommunication. It was much the same also in respect to work quite new to them, such as tent-pitching; for there was no sort of method with them, and instead of each one's confining himself always to one small part of the work and learning it thoroughly in two or three days (as I recommended), each one commonly undertook each time any part of the work that came first to his notice; so that after a while they all knew all parts of the work about equally well.

The Ainos show great skill and taste in carving their pipe sticks, cleaver scabbards and other wooden utensils, and whenever they shall become civilized will no doubt astonish the world by their sculpture. This striking point first led me to think they might be of the same race as the Papuans whom Wallace describes in the book we were reading last spring; and there seem to be some other points of resemblance. Their laughing habit is one, their mop head another. Any difference of shade in their complexion could be accounted for by difference of climate. The Ainos complexion seems to me that of a white man (myself for example) well tanned, only still darker in shade, as if still more thoroughly tanned; there is no trace of a Chinese yellow tint, as there is in some Japanese. Within a few days some newspaper account of the aborigines of Formosa and their customs seems to show a great resemblance between them and the Ainos. Perhaps from New Guinea to Yesso the aborigines are all but parts of one race slightly modified by climate.

A few words and phrases of the Aino language that my interpreter had written down did not show the resemblance to Japanese either in structure or in word that I had hoped to find. The dialect changes so quickly from place to place that the Ainos from Ishcaributo and those from Chitose (only fifty miles (20 ri) or so apart) could understand one another only by talking Japanese.

So much for the story of our trip from Kamoikotan to Ohotsunai. Hoping that you may find in it some points of interest,

I remain,

Dear Sir,

Very truly yours,

BENJ. SMITH LYMAN.

OHOTSUNAI TO BIRÔ AND TO NEMORO.

YEDO, 31st December, 1874.

General HORACE CAPRON,
Commissioner and Adviser
to the Kaitakushi.

SIR,

I beg to give you below the daily record of my work from the time of first arriving at Ohotsunai, at the mouth of the Tokachi, until leaving Nemoro; and so to fill up the only gap left in the whole account of my season's travelling.

The day (3rd Aug.) after our arrival at Ohotsunai I did some rough mapping of the route we had just travelled over; for the daily fatigues of the march had not allowed the rough map to be finished up day by day as had been customary on the Ishcari boat journey. The same work was continued the next day (4 Aug.) but was interrupted by a trial of horses necessary to a choice of one for me to ride the rest of the season. A large number had been gathered together for inspection, but all were very bad except two or three which were said to be too young. If there were really any good horses in the place,

rode to Berufune, nineteen miles and a half (7.8 ri), on the way to Biro, southward along the seashore.

The first half ri or so was level and but few feet above the sea, a part of the alluvial plain of the Tokachi River. But then the road, keeping along the beach, lay at the foot of bluffs of some fifty or seventy-five feet in height, of which the upper third was a buff sand rock and cliffy, while the lower two-thirds were of dark clay or shale and grassy. Near the beginning there was a gentle dip, perhaps 5 degrees southerly; but afterwards a still gentler one, perhaps 3 degrees northerly. The rocks seemed all to be of the same age as those which on the Tokachi river near by contain beds of lignite, as already mentioned and to belong, therefore, without a doubt to the Toshibets (Karafto) group, that they otherwise very strongly resemble.

The last third of the way (from Tobui) the road was chiefly on the plain at the top of the bluff. The land further back from the shore rises gently into low hills. At the mouth of the Ayoshuma brook, about half-way from Tobui to Berufune, we passed a place where gold was said to have been washed, especially at the time of Mr. Enomoto's visit last year, and the place had the best reputation of any in the whole region as regards richness in gold. It was said, however, that some Hakodate merchants began systematic washing here three or four years ago, but soon found it did not pay and gave it up. Since my passing the place Mr. Munroe and his party came there to make a survey, and washed large quantities of the gravel without finding more than a mere trace of gold; and he was convinced that deception had been practised by the men who did the washing last year. The gravel is at the foot of the bluff close by the brook and the sea beach, and is made up chiefly of coarse (fist size) pebbles of metamor-

phic rocks, especially blue slaty quartzite, and some large gray syenitic or granitic pebbles and a few of white quartz.

The same bluffs continued all the way to Berufune with a number of small breaks in them where small or large streams came down to the sea. At four or five such places there were lakes, two or three quite large ones, separated from the sea only by a narrow low bar of sand, which in some cases completely closed the mouth of the stream. It is quite possible that some of the lakes might be easily made into good artificial harbors, whenever there should be a sufficiently strong demand for such maritime conveniences.

The land was open and covered with short grass at the bluffs near the sea shore, but a few hundred yards back there were high open oak woods, without under-brush but bordered by very low, stunted oaks. The vegetation near the shore was not luxuriant, but the soil seemed moderately good, a light gray, rather sandy, fine loam which packs into a good hard horsepath.

There was scarcely a dwelling house in the whole distance, perhaps an Aino hut or two at Tôbui (two ri short of Berufune), at the place where the ruins of an old honjin are still to be seen. At Berufune besides the new unfinished hotel there was no other Japanese dwelling, but there were a few Aino houses. The hotel is near the bank of Berufune river in an alluvial plain a quarter of a mile or so from the sea.

The next morning (6th August), we rode to Birô, twelve miles and a half (5 ri). The character of the country, of the rocks and of the vegetation was throughout much the same as the day before ; but the road kept along the top of the bluffs or several hundred yards inland, and the upland was interrupted not only by small ravines along the sea shore, but about once in a ri by a valley

several hundred yards wide containing a river with small side channels besides the main one. The bluffs at first were fifty or sixty feet high; at Birô and near it about seventy-five feet high.

Immediately on starting we forded the Berufune river with its three or four channels separated by broad, low, brushy islands; the main channel was some fifty yards wide and a couple of feet deep with an average current of perhaps two feet and a half a second; and with a discharge, including the small side channels, of perhaps four hundred to five hundred cubic feet in a second. We understood that Messrs. Hirano and Ishikawa last year tried some places up the river, perhaps half a mile from the sea, for gold and found a little. Gold was also said to have been found on the Rakko river, one ri short of Birô, but equally little with Berufune. Mr. Munroe's washings at both these places later in the season were also as discouraging as at the Ayoshuma. No other places hereabouts were reported to us as having any gold at all. The pebbles at the ford of the Rakko River are chiefly bluish, rather coarse quartzite (fist size), blackish, fine-grained quartzite with fine white veins (large egg size), light gray syenite (about half-a-foot thick), a few white quartz pebbles (large egg size).

The village of Birô is built on the plain at the top of the bluff and proved to consist of the Kaitakushi office and the officer's dwelling, the hotel, one other Japanese dwelling and 45 Aino houses. The Ainos have been encouraged to cultivate some ground.

Mr. Sakai, the Governor of the place and of the Tokachi province, said he had travelled much into the interior, and, for example, had crossed from the Tokachi by its branch the Saoro to the Sorachi by a very low, easy pass, and had gone still further to the head waters of the Yubaribets. He had made rough maps of that and other

parts of the country that he had traversed. It is probable that, although such maps are far less perfect than those of instrumental surveys, yet they may furnish the means of correcting to some extent such maps as Matsura's, which was probably compiled originally from just such materials, and in those far inland places very likely from still more imperfect sketches. We therefore seized the opportunity of making some hasty copies of the maps, and the work busied Mr. Akiyama until we left Birô; my intelligent attendant, Mr. Isami Nomura, also kindly lent a hand to such work, although it was outside of his required duties.

Meanwhile I was myself occupied in writing the rough draft of the account of our trip from Kamoikotan across the mountains to Ohotsunai. These labors employed us busily though the rest of the 6th, the 7th, 8th, 9th (Sunday) and 10th of August.

On the 7th, I took the latitude of Birô with the pocket sextant by the sun's height at noon, and found it to correspond exactly with what is given on Matsura's map. Some other maps of Yesso place the region of Birô much too far to the north.

On the 8th towards night we visited, on the left bank of the Birô river, a hundred yards above its mouth, an exposure of green quartzite so much mixed with calcite (partly in small veins and seams) as to seem like an impure limestone. It was in a cliff some 25 feet long by 20 feet high, and the thickness of the bed exposed was about 20 feet. The beds were mostly thin (about a foot), and the rock is extremely broken up by small, short cleavages in every direction so that it could hardly be a good building stone. The dip was 70 S. 75 degrees W. The rock belongs, I doubt not, to the same group with the dark quartzites of Kamoikotan. The pebbles of the Birô river are chiefly of metamorphic rocks and

in great part the dark blue quartzite so often seen since our reaching the Upper Ishcari. There were also pebbles of two or three slightly different kinds of granite with no visible hornblende, but with blackish mica and besides that in one case a light colored mica too.

We were shown a specimen of brown hematite, a very thin layer upon a piece of dark metamorphic (micaceous ?) sandrock, said to come from Tanneesho, five ri south-westerly from Birô ; also a large hand specimen of a vein of white dolomite 0 ft. 15 thick found somewhere in the neighborhood of Birô. Both were too small to be of any value, and if they had come from large deposits, better specimens would probably have been found and preserved.

On the eighth also some horses were brought us for the trial and one was selected as a substitute for the one chosen at Ohotsunai which had proved to be too small and weak. The new horse went with us to Hakodate.

The early morning of the 11th of August was spent in writing a letter to you and instructions to Mr. Munroe, whom we had hoped to meet near Birô, but of whose approach no tidings had yet come. Near eleven o'clock, however, Mr. Akiyama and I set out on horseback for Ohotsunai again, 32 miles (12.8 ri) ; and by some mistake the baggage was equally late in starting.

About half way between Biro and Berufune, at a spot called Betsubets, some bits of coal (as we learned at Birô) had been found, and they were shown to us. They were much rounded pebbles of good looking coal, like that of Poronai for example. In passing the place so marked on the map, it appeared to be merely a gully scarcely a hundred yards long filled with grass, weeds and pebbles apparently from the Toshibets (Karafto) group, but without any exposure of rock in place. There is no reason whatever to expect to find productive coal measures there.

On reaching the main channel of the Berufune river we found it much swollen, and rising rapidly with dark brown muddy water, a swift current and much floating driftwood. The stream was indeed too deep to ford with safety and we had to cross in canoes. The rise had been remarkably sudden and was the more striking because there had lately been no rainy weather along the sea shore such as could have caused it. It was said, however, that like freshets took place whenever the wind blew from a certain direction. A warm wind might have melted snow in the mountains and might have caused rains there; and that must be the true explanation, though no high mountains were in sight. Probably the stream rises far back, in the region of the very high snowy mountains that reaches from Tokachidake to Yubaribetsudake.

On the trip from Ohotsunai to Birô and back, having now given up boat and foot travelling and taken to riding, the sketching hitherto practised was replaced by rough sketches of the topography from horse-back. The Birô horse proved to be so steady that it soon became unnecesssary even to stop him for the purpose; but the pencil could only be used from time to time at intervals of a few minutes, or in a very uniform region even less frequently, trusting to the memory sometimes for what had already passed out of sight. Such sketching was kept up throughout the rest of the season until the very last day; and the note books of the whole journey now recall all its topographical features, which would otherwise have often slipped completely out of mind. Every rock exposure also found its place in the main sketch and did not require a special drawing.

Having on our return little to delay us, except the noon meal and a little rest at Berufune, we reached Ohotsunai about six; but waited long in vain for the

servants and baggage, and finally gave them up. Hardly had we gone to bed, however, when they arrived a little after ten, having been delayed at the swollen river still more than we were.

The next day (12th August), we rode to Shiranuka 30 miles (12 ri), on our way easterly along the coast towards Nemoro.

The first ri and somewhat more lay along a beach and sand bar that stretches from the ferry at Ohotsunai to the one near the hamlet of two Aino houses called Tokachibuto, by the eastern mouth of the Tokachi. On our left were broad low grassy islands with some brush or light woods far back. After crossing the second ferry we passed at once over a lightly wooded narrow headland some 60 feet high. The surface of the hill is said to have upon it many holes which the Ainos suppose to have been dug by dwarfs, a race whose existence they believe in. At the time, however, we were not on the look-out for the holes, and did not notice them.

After coming down from that hill we rode all the rest of the way along the beach, almost always under cliffy bluffs of 60 to 100 feet or more in height. At first there was at top a layer of brown gravel 5 to 20 feet thick, and below that to the sea level seemed to be nothing but gray clay wet at top with water draining from the gravel and also grassy, both the gravel and the clay there seemed to be about level and conformable to each other. Within about a ri, however, the lower gray beds, perhaps 50 feet thick took gradually a decided dip of as much as about 10 degrees southerly (or southwesterly ?) while their upper edge remained level and was still covered, but unconformably, by level beds of brown gravel some 30 feet thick, evidently the bluff deposit quite distinct from the lower beds which seemed to be of the Toshibets (Karafto) group. Half a ri further

on, the dip of the gray beds became some 25 degrees westerly. Still another half ri, and the dip was 10 degrees easterly and the bluff perhaps 100 feet high with dark gray sand rock some 10 feet thick near the top and the rest light gray shales. A few hundred yards beyond that the dip was some 7 degrees easterly, and the rock chiefly light gray shales and a few layers of brown, especially near the bottom. A few hundred yards again brought us to dips of some 10, 15 and 20 degrees easterly; and the light gray shales were again covered unconformably with a level brown gravel bed some ten feet thick.

At length at the end of about eight ri we reached by a ferry the little village and hotel of Shakubets at the far edge of a low, flat, open prairie, half a ri wide and running far back ; and there we stopped to lunch. Close beyond, however, the high bluffs and cliffs of gray shales recommenced and continued with a couple of like interruptions and many smaller ones, as before, all the rest of the way to Shiranuka. They were perhaps a hundred feet high and very steep, but mostly covered with grass, weeds and low bamboo, with a few imperfect small exposures of gray shales. Towards Shiranuka the bluffs grew lower to seventy-five, sixty, fifty and even twenty feet ; and about a ri short of that place the bluff was grassy with cliffy exposures of brown sand and gravel at top, perhaps twenty feet thick and of gray shales below to the bottom, with a dip of hardly 2 degrees easterly ; the bluffs were grassy the rest of the way. The very neat hotel and large Aino village of Shiranuka were at the far edge of another wide, open, low, flat prairie.

The timber through the day was some distance back from the sea, and did not look heavy. The number of dwellings that we passed was very small indeed, and almost wholly made up of Aino houses, scarcely one outside of the villages mentioned.

The next day (13th August), we rode to Kusuri, eighteen miles and a quarter ($7\frac{1}{4}$ ri). The first ri or more was much like the road of the day before, along the beach with bluffs of sixty, eighty and a hundred feet or more in height alongside. Then there was a flat valley more than a ri wide and after it similar bluffs recommencing far back and approaching within half a mile or so of the sea, and continuing parallel to it for another ri or more. The rest of the way, some three ri, was a low flat prairie on the beach alongside, until the large Aino outskirts of Kusuri village and its ferry across a shallow river of perhaps a hundred yards in width were reached and the hotel close by.

About a quarter of a mile after starting from Shiranuka we passed an old coal mine, the first of the coal exposures on this part of the East Coast. The change from the rock we had seen in the cliffs all the way from Birô, and had supposed to be unquestionably of the Toshibets (Karafto) group, to the older coal-bearing rocks in cliffs above the mine was very abrupt and unexpected. But little more than a ri short of the mine we had passed the last exposures of the newer group, gray shales with nearly level dip; and above the mine we found level bedded gray sand rock that at first sight looked much like a continuation of that same group. A closer examination of rock near the mine showed it, however, to be very hard and rather coarse with many black specks in it (perhaps blackish quartzite). The coal mine was worked some years ago and long since abandoned. It seemed to consist of but one drift, at the foot of the bluff, about five feet above sea level. The mouth of the drift was filled nearly to the top with fallen earth, but I managed to crawl into it and for about eight yards along it. There it was so completely closed with fallen earth as to be quite im-

passable; but a strong current of air issued through a small opening still left at the top. As the sides of the drift were lagged it was impossible to see the coal bed at all. The thickness is, however, said to have varied from half a foot to four or five feet. There is a large quantity of the coal still lying in large heaps (perhaps 300 cubic yards in all) near the drift; but mostly fallen into slack though there are still some lumps of good looking coal of fist size. A good deal of slate is also mixed with the slack. The bed, however, even though of good quality, according to the reported thickness of it, could hardly be considered workable. The dip in the cliff just over the coal mines seemed to be about level; but a few score yards beyond, it seemed to be about 3 degrees northwesterly.

After leaving the neighbourhood of the coal mine there were no more exposures of rock in place. Among the pebbles of the main stream of the broad valley that was crossed about midway there was a little coal in bits and one bit of coal slate half an inch long; but most of the pebbles were of metamorphic rocks. The hotel was at the foot of a flat topped hill of perhaps thirty feet in height, and on the steep hill side were a few small cliffs of dark gray apparently sand rock.

Along the road the hills some distance back from the shore were covered with light looking timber and there was some brush in the valley just mentioned; but the rest of the flat land near the sea was open prairie.

There was along the whole road scarcely even an Aino hut, but at Kusuri there were besides the numerous Aino houses a number of Japanese ones, the first signs of the Japanese population at the eastern end of Yesso, isolated on the southwest and northwest by long portions of the coast where almost the only Japanese houses are the hotels and where even the Aino population is small. At Kusuri,

too, a small rocky point gave a little protection to half a dozen junks at anchor. The inhabitants were busy gathering the kombu seaweed, the principal product of the place.

At Kusuri we learned for the first time (in spite of the diligent inquiries we had made as we came along) that about a ri and a half from Shiranuka towards the Tokachi there were two places, Oshishipe and Pashikori, near each other, where a little gold had been found, "but only a very little." So unpromising a report did not seem to make it worth while to give the place a special examination, now that we had passed it so far. We were told also that about eight ri from Shiranuka on the Musaushinai brook, a branch of Kamoichikap river, which is itself a branch of the Shiranuka, there was exposed a round arch shaped saddle in the rocks of which several layers were of coal from one or two-tenths of a foot to seven-tenths in thickness; but most of the rest is clay. A sample of the coal was shown, and it was bright and looked very good.

Information was given us at Kusuri, too, of the coal places we should see on the way along shore to Akkeshi; and of the road across the island to Aoshiri near Shari and of some of its rocks. To go across there by way of the Kusuri River would be 51 ri of which 23 ri would be up the river; and, as there is no road there, the journey could not be made with horses. But from Otanoske, a spot on the sea shore 2½ ri south-westerly from Kusuri, there is an old road to Aoshiri which is 43 ri long. Of that distance the first 18 ri can be travelled with horses; then there is a gap of 7 ri that is now only passable on foot without horses; then 18 ri again to Aoshiri that is fit for horses. Of the whole distance there are 23 ri of forest road, about 12 ri of river bank or dry river bed, about 5½ ri of very good road, about

4½ ri of prairie, about 1½ ri of sea shore, and about 1 ri of small swamps; and there are 160 streams large and small.

At two ri beyond the end of the first 18 ri of the road, there are some hot springs. At 29 ri from Kusuri on the road, a dark brown micaceous course gritty (perhaps metamorphosed) sand rock is found, of which a specimen was shown and looked, except in color, much like the rock found near the Shiranuka coal mine. At Nishibets, 30 ri from Kusuri on the road, beyond the Volcano Meakan, a dark red porous, rough, light, apparently volcanic rock is found, of which also a specimen was shown; also, close by, a white rather coarse, rough-feeling sand, perhaps volcanic, of which they showed us a sample.

At Tokotan, two ri up the Kusuri river is found a gray coarse gritty sandrock just like that noticed near the Shiranuka coal mine, and a specimen was shown to us. At 25 ri up the Kusuri River, on the Meakan mountain, at a place called Matsunenobori sulphur is found, and was formerly worked but has long since been abandoned. A sample of it was shown and it was bright yellow, evidently of volcanic origin. Also from a spot called Kutcharo, 30 ri up the Kusuri river a specimen was shown us of a white clay-like mineral that seemed to be an earthy sepiolite. On being put into the water it floats but an instant, hisses, fills its pores with water and sinks. It sticks strongly to the tongue like clay. The deer eat the mineral, and the Ainos do too, it is said. It has in it what appear to be very imperfect remains of insects, wings for example, which burn up in the blow pipe flame.

We arrived at Kusuri at noon, but it soon began to rain so as to prevent our visiting the neighbouring coal places as we had planned.

The next day (14th August) we rode to Kombumori and visited also several coal places more or less near to the road, going in all 11¼ miles (4½ ri). On first starting in the morning we visited the spot called Shirito on the sea shore hardly a quarter of a mile from the hotel, and saw the so called coal there. Although we had heard of the place many miles away it proved to be very insignificant, except as showing how minutely the country was known as regards exposures of anything like coal; for the whole amounted to nothing but a seam of black coal slate one-tenth of a foot thick. It was to be seen at low tide imbedded in a broad reef of dark gray rather coarse, gritty sand rock with a few minute red specks (perhaps of jasper). The dip, if any way was perhaps 2 degrees southwest, but was gentle enough to be the end of a basin. Some 30 yards further from the hotel the dip seemed rather to be north-westerly but was very gentle indeed.

We then returned to the village and fairly set out for Kombumori, crossing within the first half mile a narrow headland by a pass some 60 feet high but with a prairie on either side some 80 feet above the sea. Then we rode along a beach busy with gatherers of seaweed, until at half a ri from Kusuri we left the shore and the road and went half a ri up the left bank of a crooked river; at the foot of hills perhaps 100 feet high. Then turning to the right up a small branch valley within a few hundred yards we came to a new coal opening that two or three men from Kusuri were just then digging at a spot called Harutori. The following section was exposed, from above downwards.

Light brown, weathered, coarse, slightly micaceous feet. sand rock, exposed ..... about	5.00
COAL, merely crop coal and poor looking	1.95
Slate and bony coal	2.25
Dark shales, exposed ..... about	0.05
	4.25

Of course such a coal bed is too poor to work. A coal bed, perhaps the same one, is opened on the opposite side of the ravine and gives the following section, from above downwards:—

	feet.
Gray sandrock (weathering brown), exposed .....about	1.00
COAL.....	1.85
Gray sandrock, exposed	10.00
	12.85

It is plainly even more unworkable than the coal at the other place, and there is no reason whatever to expect the bed to improve on digging further into the hill. The dip is gentle, but if both exposures are really on the same bed, the dip from one to the other is perhaps 15 feet in 60 feet, or 15 degrees, and the direction is N. about 40 degrees E.

We returned thence to the seashore and the main road by a different path from the one we had come, and passed over gently rolling nearly flat upland covered with thick lightwoods, until we reached wide open prarie land near the sea. A few hundred yards on the main road brought us to the old Osotsunai coal mine, within a few yards of the sea cliffs, about a ri and a half from Kusuri. It was opened by the Public Works Department of Japan in 1871, was abandoned about a year later, and is now fallen in and inaccessible. Some lumps of the coal lying outside look very good and firm, perhaps rather bony in parts. There was in fact a heap of it said to contain 2,700 koku (160 tons), covered with a poor straw roof. Our Japanese guide said the coal was in two benches, the upper one foot, the lower two feet thick, separated by one foot of black slate and covered likewise by one foot of black slate, with soft gray shales above. Counting the layers of slate, then it was reckoned a five foot bed, but yielded only three feet of coal.

The place was reckoned the best for coal in the whole Akkeshi region, and we saw none so good. The mine, as it seems, must have been a slope descending with the coal at a dip of some 20 degrees north-westerly; and must have been troubled with a gathering of water in it unless naturally drained enough by the cliff exposure only a few yards distant.

That exposure along the sea cliffs included not only the coal bed of the mine but one or two others as well as a good thickness of other rocks, and gave the following section, from above downwards:

	feet
Coarse (filbert size) pebble rock with many red, green, dark gray (a few yellow) jasper pebbles, ... perhaps	75,00
COAL (z)	0,60
Gray coarse sand rock ... ... perhaps	20,00
COAL, ... about	0,40
Gray, coarse sand rock ... ... perhaps	3,50
COAL, ...	0,30
Gray coarse sand rock ... ... perhaps	3,50
COAL	0,30
Gray, coarse sand rock ... ... perhaps	3,50
Gray shale	0,03
Coal and black slate mixed	0,60
Soft gray shale	0,55
COAL, hard and poor, with bits of amber in it ...	0,50
Gray sand rock ... ... perhaps	15,00
Gray shales with some hard sandy lumps perhaps	7,00
COAL (good ?) (y)	1,95
COAL, bony... ... ... about	0,40
COAL, good...	0,45
Black slate	0,30
Soft gray shales ... . about	5,00
COAL, good (y)	1,70
Black slate	0,20

		feet
COAL		0,55
Black slate		0,70
Soft gray shales, ...		0,60
Coal and slate mixed		0,60
COAL, ...		2,10
Slate and a little coal mixed		0,60
Light gray, coarse sandrock, partly hidden at top	perhaps	20,00
Soft gray shales		2,00
COAL, bony		0,60
Soft, gray shales		1,00
COAL, ...		1,40
Black slate		0,70
Coal and black slate mixed		0,20
Black slate		3,80
COAL, ...		0,50
Soft gray shales		0,60
Hidden	about	3,00
Light gray, coarse sandrock		4,00
Soft light gray shales		10,00
Light gray sandrock with about 2 feet of scattered pebbles, walnut size, at some 10 feet from the top		30,00
		220,00

Next to the bottom of the section is a beach, beyond which northeastward the same rocks recur with an opposite dip,

The only coal in the whole section that could be called workable is that which has the layer marked (y) at the top, and which in all has a thickness of 4.35 feet of coal within a thickness of 6.45 feet. But the same bed a few score yards nearer to the mine (which is on this bed) measures as follows, from above downwards:

	feet.
COAL, good	1,70
Black slate	1,20
COAL, good	1,20
Black slate	0,30
COAL, good	0,40
Black slate	0,80
	5,60

At that point there are 3.30 feet of coal within a thickness of 4.80 feet; and the mean between the two places would give 3.82 feet of coals. The upper bench is bright-looking and firm and seems to be of a very good quality. Still, considering the very moderate average thickness of the coal and its variableness, and the lack of good facilities for shipping it (since there is no good harbor nearer than that of Akkeshi twenty miles, eight ri, or more distant) the encouragement for working the bed is not great; and it can hardly be called at best more than just barely workable. Samples for assaying were taken from the upper, main beach. The coal of the layer marked (y) and of the one near it amounts altogether to only 2.35 feet, and is therefore quite unworkable. Two or three of the coal beds contain numerous bits of amber of mustard seed size.

From the coal mine to Kombumori the first half of the road lay chiefly at a few hundred yards distance from the sea on the rolling prairie land at the top of the bluffs, some 75 feet above sea level, and with lightly wooded hills a couple of hundred feet high a few hundred yards distant on our left. Then the road led us down to the beach again and along it under bluffs and cliffs 50, 75 and 80 feet high all the rest of the way. About midway of the upland road we came down near to the sea for a moment at the mouth of one of the numerous small valleys we had to cross; and found there a large rock

with a dip of about 10 degrees seaward and with a hole through it at the bottom. At the point where we finally came down to the beach there was a cliff of coarse, gray, slightly greenish sand rock with a dip of 10 degrees N. 60 degrees E. A few hundred yards further on there were cliffs of gray sand rock with a dip of some 5. degrees N. 80 degrees W. Still a few hundred yards further on there was a cliff with very light gray (weathering buff) sand rock some 30 feet thick above, and a dark gray sand rock some 10 feet thick below having a few scattered pebbles through the lower four feet; and with a dip of 40 degrees N. 60 degrees E. Perhaps a couple of hundred yards beyond that, there were cliffs of gray shales (about six feet exposed) with a dip of only some 3 degrees westerly. A few hundred yards short of Kombumori there was exposed a coarse gray, slightly greenish, sand rock that weathered slightly brown; with a dip of some 5 degrees westerly. Close by, the sand rock was honeycombed. The rest of the way the bluffs were steep but grassy, with, here and there, high up, a small cliff of gray sand rock showing likewise a dip of some 5 degrees westerly.

The village of Kombumori, small as it was, seemed more populous with Japanese houses than almost any we had seen since leaving Sapporo; but all through the day we had found many Japanese houses along the shore wherever a sandy beach gave a little space to dry the seaweed (kombu) that grew abundantly on the neighboring rocky reefs. Especially at Osotsunai, near the coal mine, there was a village of some size.

The next day (15th August), we rode to Chipuran, 6 ri; and went thence in a boat to see some coal at Beshakodomari, 1½ ri, and then across the bay to Akkeshi, making in all 23¼ miles (9½ ri).

Somewhat more than half a mile ("8 chô") along the beach, at the foot of grassy bluffs perhaps a hundred

feet high, and on beginning to pass inland for a few miles, brought us to the Fushikokombumori coal exposure. It proved to be only two-tenths of a foot of bony coal and black slate, in the slipped side of a small ravine near to the sea shore. Below it were exposed about 3 feet of soft gray shales ; and above it about 0.6 foot of the same shales ; and above that some 20 feet of soft coarse gray sand rock that weathered a very light brown, with a harder band about two feet thick at about five feet above the bottom. Then above that, black slate (with two tenths of a foot of coal perhaps) about a foot thick ; and above that again the same soft sandrock exposed about ten feet. About twenty yards further up the ravine (northeastward) two-tenths of a foot of bony coal are again exposed, probably the same as the lower one of the other two beds, and with shales above that are black for the same thickness at the bottom. The dip was about level. Such thin coals are of course not only unworkable, but no sign at all of the near presence of good beds.

The road, then, after going inland over broken but mainly rather flat land, rising to a height of perhaps a hundred and fifty feet above the sea, partly through heavy fir (todomatsu) woods, came down to the beach again at the mouth of a small valley, at Todomap. There was a cliff there of dark gray sand rock perhaps a hundred feet high with a dip about level ; also a rock in the edge of the water some thirty feet high and twenty yards in diameter ; and a low cliff of coarse gray sandrock, weathering light brown, at the far side of the valley. A few yards beyond, there was a rocky point of light gray, coarse sandrock with a dip of perhaps 5 degrees easterly. Close beyond, there were cliffs with dark gray soft shales, at bottom perhaps thirty feet thick, with a dip of perhaps 3 degrees south-westerly. Then crossing for a few hundred yards the tops of the bluffs 100 to 125 feet high,

with hills a couple of hundred feet high a few hundred yards distant on our left, we came down once more to the beach at Pontomari, called two ri from Kombumori. There was the following section exposed there in the steep hill side close to the sea, from above downwards :—

	feet.
Gray shales, exposed.....about	2,00
COAL	0,20
Black slate and coal mixed	0,30
Gray soft shales	1,80
Coal and slate mixed	0,35
COAL (looks good)	1,35
Black slate	0,55
COAL somewhat mixed with slate.....	1,35
Gray clay or shales, exposed.....	0,10
	8,00

The coal of the two main layers amounts then to 2.70 feet within a thickness of 3.25 feet, and is partly of poor quality ; it cannot be considered as workable at all. On the hill-side near, the same coarse pebble rock as the one found near the Osotsunai coal occurs in huge blocks, as large as a house. It would therefore seem probable that the Pontomari coal and the Osotsunai coal are the same ; but the accompanying thin coal beds do not seem to be exposed and perhaps have thinned out. The top of the section is perhaps fifty feet above the sea. The dip was about 10 degrees S. about 70 degrees E.

The road from Pontomari to Chipuran lay for the first half of the way still along the sea beach under bluffs of perhaps 100 feet in height with many dark gray cliffs and sand rock exposures. The dip was very gentle, perhaps 5 degrees at first, and afterwards 3 degrees. Midway of that portion of the road there was a detached rock, perhaps 75 feet high and 30 feet in diameter, standing in the edge of the water, with a dip of perhaps 10

degrees S. 25 degrees W. The rock there is a shale with coarse pebble rock or rather concretions of sandrock for a thickness of about 20 feet at ten feet above the sea. After that the dip (in a dark gray cliff perhaps 75 feet high) was some 5 degrees southeasterly. Then the bluffs became grassy with only small occasional exposures of rock. The road, however, soon left the shore and passed through light woods over a somewhat broken country, rising to a height of perhaps a couple of hundred feet above the sea, until Chipuran, on the bay of Akkeshi, was reached.

The last hour was travelled in the rain. But after we had lunched at the small Chipuran hotel the weather was better, and while the servants and baggage crossed in a boat (2 ri) to Akkeshi, Mr. Akiyama and I went by boat along the shore seaward (since there was no road for horses) to Beshakodomari (1½ ri), to look at the coal said to be found there. The shore that we passed near had rounded bluffs of one or two hundred feet in height with flat looking tops above, and with thin, light looking forests. Now and then there were cliffs, at first of old alluvial, light-brown and gray sands. But about half-way, at a spot called Shishamonai there were at the water's edge great cliffs, perhaps a hundred feet high, of gray sandrock weathering light-brown, and when covered with lichens looking dark gray, with a dip of perhaps 10 degrees a little south of east. To those high cliffs succeeded a small bay at the mouth of a little valley where the village of Zempoji stands. There was an exposure of gray shales in the bluff just beyond the village; and after that, the bluffs were still a little higher, and there were cliffs of gray sandrock with a dip at first of some 5 degrees easterly and afterward of about 10 degrees S. some 60 degrees W. Several hundred yards beyond that, a cliff of the same gray sandrock showed a dip of some 30 degrees S. some

60 degrees W.; and a few hundred yards further on, small cliffs of gray, slightly greenish sandrock in the bluff showed a dip of only some 3 degrees westerly.

Close beyond that, we found the Beshakodomari coal in some cliffs at the water's edge and in huge blocks of greenish gray sandrock (some 25 feet in diameter) that had fallen from them. One portion of it, said to be about 0.3 feet thick, was concealed by the tide; but it was apparently the same as was seen on the surface of a large fallen block where it had just about that thickness. In the cliff also from which the block had fallen the same layer is seen and measures likewise 0.3 feet but thins out in a few yards to a knife edge. The rock there is a coarse (walnut to fist size) pebble rock like that of Osotsunai with red and green pebbles of jasper. The cliff just there is said to have settled down some years ago, but the dip is still nearly horizontal, say 10 degrees S. 70 degrees W.

A very few hundred yards more brought us to the house at the mouth of the Beshakodomari ravine. We landed again and went up the steep hollow to the right until at the height of 240 feet (by aneroid) above the sea we reached another small so-called coal exposure. The bed was of coal and black slate mixed, and was 2.1 feet thick, close below the top of the ravine and the brow of hill. The dip was 30 degrees S. 35 degrees W. Above the bed was coarse, brown weathered sand rock, exposed to a thickness of about three feet. Below the black bed there seemed to be shales, but they were very poorly exposed.

We had now visited all the exposures of the coal of the Akkeshi coal field, all lying between that town and Shiranuka. One bed at Osotsunai was the only one of them all that had any pretensions to being workable, and even that could probably only be worked in a very small way to supply a local demand. Not only were all the

other beds decidedly unworkable, but most of them were wholly insignificant. They show, to be sure, by their widespread fame in spite of their smallness how thoroughly the country has been searched for coal, and how improbable it is that any other exposure of workable coal has been left undiscovered. It is not likely that any other more workable bed would be left wholly unexposed in so large a space ; and it is therefore almost certain that none such exists. All hopes, then, built upon the Akkeshi coal-field, so near to the sea and to a fine harbour, must fall quite to the ground.

In the boat we had rowed so far, but now set out for Akkeshi across the bay with a sail up. A fog soon settled down on the hills so as to prevent any further sketching, even if there had been much more to sketch. In less than an hour and a-half, however, we were passing under bluffs of a couple of hundred feet in height with cliffs perhaps 150 feet high, a little to the seaward of Akkeshi, and were mostly relieved of the fog. The cliffs were of gray sandrock with a dip of some 15 degrees S. about 80 degrees E. at first; but on coming close to the village we found the dip had become perhaps 50 degrees in the same direction. The rocks all seemed to be the same as htose we had left near the coal beds on the other side of the bay.

Finally, at nearly half past six, we reached the hotel of Akkeshi. The village was smaller than we had expected from the fame of its comparative importance and of its excellent harbor ; but the place was at least much larger than any we had seen for about two months, and there was even a small number of shops. Half-a-dozen new houses building seemed to show the place was prosperous. The day's journey had been through a region more thinly inhabited than that of the day before and the only dwellings at all were on the sea shore.

The Akkeshi harbor is well protected and is said to have the very best holding ground, mud or clay.

The next day (16 August) was Sunday, and we staid at Akkeshi. I walked about two miles to the ferry at the far end of the town, where a narrow strait joins the bay to a large inner basin or lake. An Aino at the ferry said the water at the ferry was 20 feet deep, but that it was less inside of that. The beach of that part of the bay had a great number of the shells of oysters for which the place is rather celebrated ; and one shell, though worn by the waves, measured 0.95 foot in length.

A few score yards back from the shore were hills of two or three hundred feet in height, with a cliff of gray sand rock near the ferry that had a dip of some 40 degrees westerly. About half-way however, from the hotel to the ferry a similar cliff had a dip of some 45 degrees easterly.

The next day (17 August), on our way to Ashirikotan (Hamanaka), twenty-three miles and three-quarters (9½ ri), we passed the last mentioned dip, and went up a small valley to the right of it and over a pass between low hills. The road kept on inland over somewhat uneven ground, perhaps two hundred and fifty feet at most above the sea, through light woods most of the time (at one point a few heavy firs), sometimes merely dwarf oaks, sometimes through open land covered with low bamboo. Now and then the sea came in sight several hundred yards to our right. The first such place was about two ri from Akkeshi ; and a cliff, perhaps a hundred and fifty feet high, of dark gray sandrock was to be seen on the shore with a dip of some 15 degrees easterly. A ri further on (against a wayside resting house) there was likewise to be seen a sea cliff of dark-brown weathered pebble rock with a dip of perhaps 30 degrees easterly. Several hundred yards

beyond that, a like dip was again seen in a sea cliff. But opposite the end of the fourth ri there was a cliff of dark brown weathered coarse pebble rock perhaps a hundred feet high with a dip of some 20 degrees westerly. A few hundred yards further on, however, the dip had changed again to some 30 degrees easterly. Near the end of the fifth ri we crossed by a bridge a good-sized stream at a village of near a dozen houses close by the sea shore; and just beyond, there was a cliff perhaps fifty feet high of brown weathered sandrock with a dip nearly level, apparently the bottom of a basin. Several hundred yards more, over a hill, brought us to a still larger stream with a ferry and another village of about ten houses. Just beyond that on the sea shore there was a cliff some fifteen feet high of the same coarse pebble rock we had seen at Osotsunai; and a few hundred yards further on, the same rock in a cliff ten feet high gave a dip of some 5 degrees easterly. Then we climbed the hills again and rode through several hundred yards of much the same country as before, until we finally came down to the sea shore again alongside of a dip of about 5 degrees easterly at the edge of a wide, low plain, a couple of ri from Ashirikotan. The road thenceforth lay along a sandy beach with houses every thirty yards or so the whole way. For in spite of the length of the beach there were rocky islands and headlands near that gave a foothold for seaweed. The islands seemed to be a couple of hundred feet high and were surrounded on all sides by high cliffs of dark-gray rock. One large island (formerly) about midway of the beach road is now connected by a low sandy beach with the main land, and in connection with three or four smaller ones gives some protection to a bay just short of it. At last we reached the hotel of Ashirikotan long before coming to the end of the beach and of the houses. The long beach is called Hamanaka.

The next day (18th August) was rainy and we did not leave Ashirikotan. An illness that seemed slight at first had attacked me the afternoon before; but the day was partly spent in report writing and other office work.

The following day (19th August) Mr. Akiyama and I with some of our attendants rode to Otchishi, twenty-two miles and a half (9 ri), along the coast on the way to Nemoro while the rest, with the chief part of the baggage, took the inland road by Atsuushibets, an easier road it was said, but without the numerous rock exposures to be seen on the sea shore. After starting we rode still half-a-ri along the beach past the continuous village of Japanese houses. Then bluffs began again perhaps 150 feet in height; and there was at the outset a cliff some 100 feet high of light-gray, coarse sand rock and coarse pebble rock with a dip of perhaps 30 degrees westerly. Then for a few hundred yards the bluffs, though steep, were grassy without any cliffs. The road then on approaching a dark-gray cliff left the beach and crossed over a headland perhaps 250 feet high, open land covered with short bamboo, and with light woods some hundreds of yards back. Descending after several hundred yards to the beach again we found a cliff of gray shaly sandrock with a dip of some 15 degrees easterly; but a few yards beyond, another cliff of somewhat shaly light-gray sand rock gave a dip of only 0 to 5 degrees easterly. Then crossing the mouth of a long flat valley with a small village we came to bluffs again and a cliff of brown weathered coarse sandrock with a dip of some 15 degrees easterly. A few score yards beyond, there were cliffs, perhaps seventy-five feet high, of coarse gray sandrock with a dip of some 20 degrees westerly on the side of bluffs a hundred and twenty to a hundred and fifty feet high. Then for a few hundred yards the bluffs were grassy without cliffs, and a broad flat valley of a few

hundred yards in width succeeded. The sea alongside seemed in great part well protected for a wide space, made in fact into a harbor almost, by large islands some distance from the main land.

The road then at the far side of the valley ascended the bluff some two hundred feet high, passing at the foot a cliff of gray sandrock with a dip of some 20 degrees westerly (or southwesterly). Within a few hundred yards the road came down again into a small flat valley close to its mouth in sight of a cliff of brown sandrock on the far side by the sea with a dip of some 20 degrees easterly. The road, however, turned from the shore and pushed inland, passing over hills a couple of hundred feet high, through some thin light woods and some open spots covered with low bamboo and weeds. After a ri or more we came down again to a sea beach at a cliff of gray sandrock, shaly below, with a dip of some 30 degrees easterly. There was a wide flat valley there with half a dozen houses; but after several hundred yards the bluffs along the shore recommenced, though scarcely more than forty feet high at most, chiefly grassy but with some very small cliffs that showed a dip of 45 degrees southeasterly.

At the end of nearly a ri of beach road it was cut off by a cliff some one hundred feet high with an easterly (or perhaps southeasterly) dip. The road climbed over the hills again to a height of a couple of hundred feet, chiefly through open land covered with low (about 2½ feet high-bamboo and weeds, but with brush here and there and thin light woods some hundreds of yards further back) Such a road lasted for several miles with occasional descents into narrow valleys and occasional approaches to the sea, within sight of it, or even passing at one point (perhaps midway) over a stony beach for a few hundred yards. Several hundred yards from the beginning of that upland road we saw cliffs of gray sand rock on

the sea shore with a dip of some 40 degrees easterly. A few hundred yards further on there were cliffs of gray sand rock some 30 feet high with a dip of about 30 degrees easterly (or south-easterly); and just beyond, cliffs of gray sand rock some 60 feet high. Several hundred yards beyond that and beyond the strong beach there were cliffs of gray sand rock perhaps 20 feet high, and a few score yards further on, a small exposure of gray sand rock with a dip of some 20 degrees easterly. A few hundred yards still beyond, there were gray sand rock cliffs some 50 feet high with a dip about level. A few hundred yards more brought us to the mouth of a small valley with cliffs of gray sandrock on both sides towards the sea, from 10 to 30 feet high and with a dip on the near side of some 20 degrees easterly.

At length, several hundred yards beyond that, the road came down to the beach for the last time and kept along it all the rest of the way to Otchishi, a ri and a-half or more. The bluffs continued alongside, with the exception of a couple of small valleys; but were only 50, 40 or 30 feet high, until midway a height of a hundred feet was reached, with a cliff of gray sand rock with a dip of 40 degrees southerly. A few score yards short of that there was a small exposure of gray shaly sand rock with a dip of about 10 degrees westerly. But a few yards beyond there was an exposure of very much contorted beds, probably at the axis of a basin (synclinal). The bluffs then became lower, down to some 70 or even 50 feet, and were grassy all the rest of the way with but one small exposure, at mid distance, of gray sand rock with a dip of some 10 degrees westerly.

Otchishi consisted of but one or two houses and the road for some miles had been very little inhabited. A clean corner of the main building was fenced off for me with screens, and we staid there over night.

Beyond the house a headland ran out seaward with flat-topped bluffs of a hundred feet or more in height, grassy but somewhat cliffy, with a dip of perhaps 10 degrees westerly.

That evening and the next morning (20th August), the slight illness of the last day or two grew worse, so that the strictest fasting was adopted as a cure. But in the morning we rode on to Nemoro 12½ miles, (5 ri). A thick fog for some time limited our view and was rather bewildering

The road at starting crossed the headland within a few hundred yards by a pass hardly 25 feet high. On reaching the sea again, we saw a cliff some 20 feet high of gray slightly greenish shaly sand rock with a dip of about 15 degrees easterly or southerly. We turned our back on that cliff and rode along the beach under bluffs some 40 feet high with exposures of sands and clays that dipped some 40 degrees easterly. At the end of several hundred yards, however, a cliff some 30 feet high with a pulpit rock about 20 feet high forced us to climb over a flat topped headland perhaps 150 feet high, open along the road, but with light woods further back ; but in a few hundred yards we came down again. The road then passed for several hundred more yards along a beach under bluffs of 100 feet or so in height, mostly grasssy, but with an exposure, near the beginning, of dark brown, coarse (fist size) pebble rock without any clear dip ; and at the end a cliff of dark weathered pebbble rock or perhaps sand rock with a dip of some 20 degrees easterly. The road then passed over another headland with features like those of the last, and came in a few hundred yards down to a beach opposite to pretty large, flat-topped, off-lying islands that must give some protection to the sea inside of them. A few hundred yards beyond, there was a succession of exposures a few score yards

apart of dark brown weathered sand rock with south-easterly dip; gray shaly sand rock with a dip of some 5 degrees south-easterly; gray shales with south-easterly dip; gray shales with a dip of some 20 degrees easterly; shales with dip of some 10 degrees easterly; dark gray shales with a dip of some 30 degrees easterly. The bluffs some 60 feet high then drew back from the beach, and left a broad flat valley that contained a dozen houses and reached along the shore to the boundary post of Nemoro district. Near the post there was an exposure of gray coarse sand rock weathering brown with a dip of some 2 degrees easterly. The road at the same point went up over another flat topped headland some 150 feet, high, mostly open land but with some light woods back. But in a few hundred yards we came down to the sea shore again at a cliff of dark weathered gray sandrock with a dip of some 25 degrees easterly. Then several hundred yards along the beach at the side of the low, broad, flat mouth of a valley brought us to a small hill with a cliff at its end, dark weathered gray sandrock with a dip of some 25 degrees easterly. Only a few score yards beyond this, at a small hamlet, we finally left the sea behind and crossed over the narrow eastern peninsula of Yesso, a couple of ri to Nemoro, without seeing any rock exposures on the way. The highest land seemed to be only some two hundred or three hundred feet high, mostly flat or gently sloping, nearly open or covered with scattered light woods.

I had thought of making, while so near, a flying visit to the large outlying islands of Kuneshiri and Etorop, if the steamer *Capron* could conveniently take us on one of its cruises in that direction. She proved, sure enough, to be in port when we arrived at Nemoro, but on going aboard the same afternoon and visiting the sick captain, I learned that she would probably sail within

a few days in another direction. It turned out, too, that we should hardly have had time for even a hasty steam voyage round the islands. There is little doubt, however, that the whole of both of them is volcanic; and we could see one or two beautiful volcanic cones on Kuneshiri just north of Nemoro.

We were, however, informed that the Kaitakushi had sent two of its officers on an expedition of exploration for minerals to Kuneshiri and Etorop after they had spent some time in a similar way on the mainland near Nemoro; we had heard also of another pair of officers engaged in like duty in the Tokachi valley and near Birô. Both parties were sent into the field on business of which I have nominally full charge, but both were sent without the least consultation with me; and no report whatever of the results of their explorations has been given me, beyond mere hearsay accounts at second or third hand. Any special previous consultation may have been thought unnecessary because two or three similar exploring parties were kept in the field last year. In regard to them, however, I was specially consulted in advance within a few days after my arrival in Japan, and told that they were important because the Ainos had so much dislike to reveal the mineral resources of their hunting grounds that it was desirable to send such scouting parties in advance. I was in that way persuaded of the propriety of the measure; but have since found no reason whatever to believe that it was judicious or anything less than the cause of a complete waste of money. No report from any of the parties, beyond a very brie- verbal one from two of them in July of last year at Sapf poro, has ever been made even indirectly to me; not even a list of mineral places furnished for the benefit of my subsequent journeys over the same ground; and no authority has ever been given me over those pioneer ex-

plorers so as justify my requiring a report from them. On becoming better acquainted with the Ainos, I have failed to find the slightest disposition to conceal any of the natural mineral treasures that they know about; on the contrary, they seem inclined to give all the little information they have on that subject, though too much unacquainted with the value of the peculiar minerals they have noticed to think them always worth mentioning. The officers in question would seem, with hardly an exception, to have visited only mineral places that were already known for a long time to the Japanese, especially to the local officers and inhabitants, and to have discovered scarcely a single new place. Their examination of the old places has not yet seemed to throw much new light on their mineral value nor on the general geology of the country. If the Kaitakushi has, or can obtain the services of any one man (whether native or foreign) in whom it can place sufficient confidence, I would recommend that all the geological explorations without exception be entrusted to his sole guidance.

The 21st, 22nd, 23rd, 24th, 25th and 26th of August, I was busy copying the long letter to you that gives the detailed account of the trip across the mountains, and Mr. Akiyama was busy most of the time in copying some maps of the neighboring country that we found in the Kaitakushi office at Nemoro. Meanwhile my illness had grown worse, but had finally been starved out, so that eating could at length be safely recommenced after several unsuccessful attempts; the consequent emaciation and weakness, however, were very unusual.

On the 27th of August, however, Mr. Akiyama and I (leaving behind the interpreter who had the night before returned to us from Sapporo) rode from Nemoro to Noshaf, the very easternmost end of the Nemoro peninsula and of Yesso, and back again, 30 miles (12 ri) or more,

in order to see the rocks that might be exposed on either shore. We went by the north-western side and came back by the south-eastern. All the way round, the land rises from the shore, first in a bluff fifteen feet high and then very gently indeed to a height of perhaps 200 feet. The first rocks we saw, even before we reached the outskirts of Nemoro, were brown weathered shales level bedded; but only a few yards beyond was a small cliff of dark crystalline blackish and gray volcanic rock with a dip of some 20 degrees S. about 50 degrees E., and a ledge of the same with a cleavage (or else a dip) that was about vertical. Volcanic rocks, mostly of similar appearance, were exposed beyond that almost continuously along the foot of bluffs at the edge of the water almost all the way to Noshaf, with here and there a little beach at the mouth of a small valley. The dips were: at the end of the small point just outside of Nemoro, about level (?); a few hundred yards beyond that, some 25 degrees south-easterly. The strike seemed generally to be north-easterly all the way. At mid distance or rather more, on a good-sized stream near its mouth was a curious, nearly circular, low, flat piece of ground a few hundred yards in diameter, through which the river wound. All around were bluffs some twenty feet high. The place looked as if it might be the remains of a volcanic crater much worn down.

On the return along the south-east side of the peninsula the same volcanic rocks were seen here and there at many places; but at length at Oshinetsupu (Oshinebets? of Matsura's map) commonly called Honioi for shortness, within two ri of Nemoro, there was a cliff of dark-gray (weathering brown) sandrock with a dip of 15 degrees S. 50 degrees E. It was probably the easternmost limit of the coal rocks that we had found all the way eastward from Shiranuka; for although there are no coal beds east of

Akkeshi, the rocks seem to be of the same group as in the coal field adjoining on the west.

In going round the little peninsula we found the land near the sea bare of trees and covered with low bamboo and grass and weeds; but a few hundred yards back it has light wood. The shore on the northern side has very few houses, mostly deserted, for the moment at least, but on the southern side there were a great many more, in groups of two or three or half a dozen, where there were sand beaches (which are rare on the northern side). The fishery warehouses bore the mark of "Mataju," the same merchant, I take it, whom I have within a few days seen mentioned in a Yokohama news paper as doing business under that name and as having risen from ruin half a dozen years ago to an income last year of seven hundred thousand dollars!

The chief occupation along the shore is gathering the seaweed called kombu (something like our kelp, or quite the same), which is sent in such large quantities to China; and a certain amount of fishing is also done. The kombu grows upon submarine rocks, but for drying it a wide, flat space is needed, and the houses, therefore, are placed along the sandy beaches; and almost every beach however small is occupied. The weed taken with a boat, is spread out in the sun in long strips, 20, 30, even 50 feet long, and at night is gathered into little heaps and covered with matting; every eight strips are tied together at the end and coiled up before putting into the heap. The long narrow leaf of the weed is thick and fleshy, and when chewed is very mucilaginous and has an agreeable taste even when raw; but it is a very important and excellent ingredient in soups, and when simply toasted to complete dryness for a couple of hours before a slow fire is delicious. It is also cooked in other ways. The sea salt in the substance of the leaf or on its

surface gives a very agreeable seasoning; and it has been said that the Chinese prize the weed according to the amount of salt retained upon it. But on the East Coast no care seems to be taken to keep the kombu clean, and it must be washed before use, and thereby some of the salt must be lost. On the shore east of Hakodate last year they seemed to be much more careful about cleanliness while the drying was going on.

When we were at the extreme end of the peninsula we stopped to lunch in the lonely but hospitable light-house of Noshaf; and were struck with great admiration at its neat and well-kept appearance. It is closed every year from the 15th of November to the 15th of April. It belongs to the Public Works Department of Japan and is very creditable to it.

Nemoro itself is but a small place, perhaps 30 or 40 houses and a dozen shops in the main village, rather larger than Akkeshi. The harbor is protected on most sides, but is open towards the north-east from which bad gales sometimes come. By closing with a breakwater a gap of perhaps a quarter of a mile from the main land to the end of a long island parallel with the shore and over against the town the harbor would become an excellent one, though small. Abundant materials for such a breakwater are close at hand. The holding ground is said to be poor, only hard sand; but the steamer *Capron* rode out a heavy gale there during our stay at Nemoro.

The country about Nemoro and, indeed, all the way along the coast from Birô, seemed very well fitted for the raising of horses and all kinds of cattle; for there were many wide tracts of open, grassy, pretty level land. Horses indeed, were numerous, grazing at large. At Nemoro were the only neat cattle of the whole region, ten in number, of large size and of a black color spotted with white. As the inhabitants have not yet acquired a taste

for milk, butter or cheese, the cattle are used only as pack animals, and are said to carry one-half as much as horses. They are supposed to eat about the same amount of food as horses, but except for a very few days of the deepest snow in winter no provision is made for any of the animals, and they have to pick up the grass as they can ; in summer they are not fed at all. The climate is very good for cattle raising ; but it would of course be very advisable and in reality economical to provide good hay and grain and the protection of barns and stables. Cold and hunger must at present do great damage to such animals in winter time.

The fatigue of the day's trip (much longer than had been expected) was too great for a very weak state of body and brought back my illness ; but it had again disappeared by the next day (28th August), which was spent in office work, writing letters to yourself and to several of my assistants who needed instructions. The morning of the 29th, was also spent in letter writing ; but about noon we set out on our journey northward, as recounted in the detailed report already given you of that part of our field work.

I have the honor to be,

Sir,

Your most obedient Servant,

BENJ. SMITH LYMAN,

Chief Geologist and Mining Engineer.

FROM NEMORO BY SOYA AND HAKODATE TO YEDO.

SHIBA, YEDO; 23rd November, 1874.

GENERAL HORACE CAPRON,

Commissioner and Adviser to the Kaitakushi.

SIR,

I have the pleasure of sending you herewith at last my report on the field work from my leaving Nemoro until my return to Yedo.

It is very full in its daily account, because I thought both you and the Kaitakushi could hardly be too minutely informed as to the manner in which my duties were performed. It was wholly planned and mostly written before I had any knowledge that you were thinking of printing it; yet it was all written under the impression that any part of it might by a bare possibility at some day come before the world. It may, however, very well happen that some portions of it may seem to you of too little importance and interest to the public to justify printing them; and in that case I shall be happy to omit, shorten or remodel them.

I beg, however, to say that the very lengthy geological and topographical details, however uninteresting, they may be even to a professional reader, are of just the kind that ought to be printed at Government expense, as they often are by Societies. Though information of so little popular interest could otherwise scarcely get published, it is very useful to place it on record so that it will be accessible to any geologist who in the future may wish to study the region traversed, and his labors thereby will be greatly lessened. Such a record, too, is a perpetual answer to a thousand questions that may arise from time to time in the minds of the different Government officers who may be sent to that part of the empire.

I have the honor to be,

Sir,

Your most obedient servant,

BENJ. SMITH LYMAN.

GENERAL HORACE CAPRON,

Commissioner and Adviser to the

Kaitakushi.

SIR,

I have the honour to make you the following rough report of my work, and beg that you will transmit it to the Kaitakushi (for which purpose I send herewith a Japanese translation to accompany it). It has been written in the field from time to time (chiefly as the dates indicate), in order to keep you as promptly posted as possible, and to give the advantage also of writing while the subject is quite fresh ; but such a report will naturally be liable to many corrections at the end of the season, and would of course, hardly be fit for immediate publication without revision.

* * * * * * * * * *

Although I shall leave out of the report some strictly personal matters that were formerly sometimes put into the letters on account of your friendly interest in me ; still I shall not scruple to mention, as before, many things not purely geological. For the Kaitakushi may either find such information valuable on account of its newness, or may at least find both interest and use in looking for a moment at even well-known things through the eyes of a foreigner who has lived long in several other parts of the

world. If I should now and then relate an amusing incident or even make a small joke, I trust that they may not be thought wholly out of place and that they may lighten the task of reading through what might otherwise seem a dreary waste of dryness. If here and there a criticism should be made upon the existing state of any affair, and a change of some kind should be suggested, I hope it will be perceived that it is not done in the slightest degree from any personal ill-feeling, but wholly from a thoroughly sincere desire to be of service to the Kaitakushi (for more than one of whose officers I have a hearty personal respect), of service to the Government in general and above all to Japan, the Sleeping Beauty that the young Prince (America) came to awaken to fresh life and renewed loveliness.

Shibets, 31st August, 1874.—In writing from Nemoro I should have mentioned that large quantities (it is said) of pretty pebbles are found on two islands off the end of the peninsula, the end where the well-kept light house is of which I spoke, called Noshaf. One island is called Suisho (Rock Crystal) Island and is but two ri from Noshaf. We could see it well with our glasses, a low flat-topped island, two or three miles in diameter, without trees. The other island is called Taraku, and lies five ri beyond, and is also larger, perhaps twice the diameter. The pebbles are said to be found on the beach in each island, and not to be found in any solid rock. Some samples were shown me, and they were of the size of a walnut and less; and were all of quartz in one form or another, a few glassy, many agate and many jasper of various colors. Some of the agates were very pretty from having extremely thin parallel, crooked layers of different colors; they would look very well, when cut and polished, in sleeve buttons, shirt studs, brooches and the like. How large a quantity can be obtained cannot be made out very

clearly from the description given ; but a great abundance is very positively declared to be there ; whether that means a thousand good pebbles in a year's searching, or 365,000 it is impossible to judge. I had thought of visiting both islands, but was informed by the Governor of Nemoro that, though it would be easy to go to them, the return might take a week or more. There is a very strong current against the return, and very good winds would be needed. The excursion was therefore given up.

While writing you my last letter on the 28th of August a violent rain storm set in which lasted until the next morning; so we left Nemoro about noon on the 29th. Before going I went aboard the steamer *Capron* to bid the captain good bye and see if he could take my budget of letters (including the detailed account of the trip across the mountains) to Hakodate; but it had become uncertain whether he should go there at all or not, as "they were waiting for somebody to arrive from Sapporo." As it would in a few hours be too late for even the steamer to overtake you at Hakodate, the letters went by land. There is not yet any letter-post as far as Nemoro, but they are just now about establishing one, a great step forward.

My Japanese companion was greatly struck by the extreme cleanliness of the ship. I found the captain better in health but still uncertain whether his disease had not become a very serious one, which would require the aid of a skillful surgeon. The captain was almost famished for fresh vegetables having eaten up some I had sent him at first. It seems that his paymaster, having an allowance of sixty dollars a month for the captain's food had laid out the whole of the money of the first month or two in supplies for three months or so, and consequently felt unable to purchase any-

thing whatever until a fresh month should arrive, although he had the money in his hands. The captain was therefore eating last year's potatoes and the like; although there had long been new ones in Nemoro. You can see from this of itself how utterly false is the insinuation of ill natured journalists that there is no honesty nor economy in the Kaitakushi. It was, in fact-but one instance among ten thousand of the strict economy that really prevails in the Kaitakushi and that extends to the minutest details.

The real difficulty no doubt was not ill-will nor stupidity on the part of the paymaster, but ignorance of the best modern methods of keeping accounts, which seem generally to be little known in Japan. For instance, the merchants here call their book of original entry their "water book," because when its items have been copied into the ledger it is washed clean again; a plan that necessarily takes away all possibility of tracing with any certainty the facts in regard to any outlay or receipt of money, and opens the door to a thousand errors and frauds. The introduction of modern book-keeping has long seemed to me to be a matter of the very greatest importance not only to the mercantile community of Japan but to every branch of the Government; for not only would it make fraud in the outlay of the large sums of Government money almost impossible, but it would render possible at all times the removal of any doubts as to the course such money has taken.

We came in the afternoon about 21 miles (8½ ri) to Atsuushibets, on the shore of a lake half a mile or more in width (of which a lovely view is cut off from the honjin by a most unnecessary fence); and there I hoped to pass a quiet Sunday. But the honjin was not over-clean and so infested with swarms of mosquitoes as to be intolerable. After having been kept in torment (even

with an imperfect mosquito net) from the end of my first sleep, perhaps two o'clock, until about four, I rose at the beginning of the dawn, and rested better while walking in the yard until about five. Then an early breakfast was given me, and the ferryboat was got ready, and I was off before six on my way to Bekkai, on the sea shore, two ri distant, where I arrived a little after 7 o'clock, and where we spent the rest of the day, although there were some mosquitoes there and the honjin was not the very best.

Indeed ever since we reached Akkeshi we have greatly missed the beautifully neat honjins and extremely polite treatment that we had found almost everywhere on the way from Birō; until to-day there seems again a little improvement here. Why one whole province should differ so from another is hard to understand. The reason is perhaps that the province of Nemoro is more populous and the honjins are therefore more frequented and become dirtier. That reason would however hardly apply to the room given me at Akkeshi, for the landlord was at first unwilling to give it because it was reserved for the Hangan (the only one of that rank, I believe, is the Governor of Hakodate)! and his visits cannot be very frequent. The landlord thought the room, poor as it was, too good for an American geologist who had at head-quarters been reckoned so much more important to the Kaitakushi than even a Hangan; but perhaps he judged the stone by its setting, not knowing its cost.

The simple hotel-keeper's harmless contempt for me as a foreigner (so I took it to be) is hardly to be wondered at when even the Government treats its foreign servants in some important respects (quite unlike the custom under other Governments, the English, for example) as inferiors I do not say of Japanese officials with like salary, but even of the lowest native official, however,

young and ignorant; a treatment that seems to me like a leaden setting to a costly gem. I mention the matter because it seems to me to be one of the highest importance to the Kaitakushi and to the government generally; for it is one of the chief reasons why Japan finds it so difficult to obtain even at great expense satisfactory foreign servants, and having after trial sometimes found them, so much more difficult, even, to keep them.

The repose of nearly a whole day at Bekkai was most welcome, and was needed almost wholly for bodily rest alone; for in spite of my illness at Nemoro there had been, including Sunday, but one whole day lost from work in all; and before that days of rest were quite rare.

This morning we came 20 miles (8 ri) to this place, still on the sea shore, and our road was a great part of the way close to the sea; as it has been all the way from Nemoro, except the last half of the way from Nemoro to Atsuushibets. The country all the way from Nemoro has been very low, often for large spaces quite flat (especially from Atsuushibets to Bekkai); but commonly with a low bluff near the sea shore rising to a height of fifty feet or so and with nearly flat land at the top, but of course somewhat rolling here and there because of streams. The shore is mostly sandy, seldom pebbly, and the bluff covered with grass; and since leaving Nemoro, has been quite free of any rock exposures, and seems to be chiefly made up of alluvial matter, which is sometimes exposed. Further back from the shore the ground seldom seems to rise to a height of more than 75 or 100 feet; but the eye may be deceived, the slope is so gentle. Near the shore there are commonly no trees, but some 300 yards back small ones begin and further back grow larger and larger, but seem even in the end to be light; and this morning they were also very thinly scattered. They are mostly hard wood trees, but the other side of Atsuu-

shibets there were a good many firs, though no heavy ones.

Chiraiwatara ; 1st September.—This morning we came here from Shibets 18¾ miles (7½ ri), no longer along the sea-shore but directly inland, and instead of northerly somewhat south of west. For there is, a dozen miles north of Shibets, a peninsula that juts out north-eastward some forty miles into the sea and is covered with high mountains across which there is no road, nor around them on the shore either. The road instead goes by a long circuit inland three days' journey from shore to shore through a comparatively level country. It seems that thirty years or so ago there were several such roads across this end of the island, and we heard of one near Kushiro, that at the north end comes out out near Shari (the place our present road leads to) and that is still to be traced and, all but seven ri in the middle, is still passable for horses, and the old ri posts and ruined honjins are still to be seen. They say that in those times this part of the island was much more thickly inhabited than now and very prosperous ; men travelled in kangos and were men of leisure, after 300 years of peace. But wars came in Japan, and the troubles that followed the coming of foreigners, and gradually the settlements here fell into decay. I had some thoughts of crossing the island by that road, 41 ri, and back again ; but on counting up at Nemoro the number of days still at our disposal we found that we could not safely expect leisure for that trip of twelve or fifteen days in this stormy season. There was nothing of special interest to be seen on the road, so far as known, except a hot spring and some volcanic sulphur that was once worked and was abandoned ; and therefore was probably scarcely workable, to say nothing of the well-known fact that such deposits are in all countries very small, as we found them at several places last

fall. The road was said to pass by a large lake. In going over the road I should have hoped to see something of the rocks here and there, but perhaps should have seen nearly as few as on this road; that is, so far none at all. The existence of such roads and of a Japanese population formerly in the interior, shows how very unlikely it is that any deposit of valuable minerals there should have escaped notice.

On the shore northwards of Shibets, two ri distant at the foot of a bluff close to the sea, Mr. Hirano and his Japanese companion last year are said, with the help of two Ainos, to have washed for gold and in half a day to have found altogether ten very minute grains, or an average of five such grains a day to each man. The result was so poor as hardly to justify our going out of the way to take a look at the place, much less to stop and wash a large measured quantity of the gravel.

Still further north and a ri and a half from the sea-shore, at a distance of twenty eight miles and three quarters (11½ ri) from Shibets, of which more than half is impassable for horses and therefore must be travelled a-foot, are some hot springs; quite small according to the description, a number of slender threads of water issuing from the ground within a space some fifteen yards long; but very hot and having a slight smell of sulphuretted hydrogen and a small deposit of white sulphur along the edge of the water.

Beyond the hot springs it is impossible, they say, to go even on foot along the shore to the end of the peninsula; and by boat the current is so strong that it sometimes takes eight days to make the trip. It was then out of the question for us to go that way to see the rocks, which must therefore be studied, if necessary, on the other side of the peninsula. The sea is said to have been sounded on this side to a depth of a thousand feet.

Along the sea shore this side of Nemoro there is no gathering of sea-weed owing to the absence of rocks for the weed to grow on; but there is a little herring and salmon-fishing.

The road we came over to-day was on the whole nearly level, though passing at times over heights of fifty feet, or say a hundred or more above the sea, and in the main following up the valley of one river, the Shibets, which was, however, commonly far out of sight. The slopes were generally very gentle, but near this end of the road there were bluffs of fifty feet or so in height with nearly flat land both above and below. The woods were almost everywhere very light, commonly mere brush, and commonly very thin also, with several pretty large open spots. The largest one was a mile-and-a-quarter (one-half ri) or so long and perhaps a quarter of a mile (one-tenth of a ri) wide, containing therefore a couple of hundred acres. It was covered with short grass and weeds and bamboo. The ground everywhere in fact to-day was covered with low bamboo, commonly very thick. The road was the narrowest possible horse-path, in many places nearly overgrown, in others lately repaired, as if passers by had been expected.

It is said, however, that there are commonly hardly three men passing over the road in a year; and we passed but one dwelling on the way, and that not very far from the sea. It seems almost a wonder then that the road should be kept in repair at all and the honjins kept in use, especially when you consider that those are not kept up by the government. There are in fact no honjins properly so called in Yesso, they all a few years ago passed into private hands and are merely hotels, a system that seems to work admirably well. Here, for example, although the house is small and old it seems to be well attended, and the most polite and hospitable welcome was

given to us travellers; although the fixed price agreed upon at the outset of the private management of the old honjins, thirty cents a day for each traveller, whether lodged in the best room or in the kitchen, even with the customary addition of a voluntary payment for the tea by the occupants of the best rooms, is far too little to repay the expense of keeping up the house all the year round, and though the landlord himself is paid a salary and has no interest in the travellers' fees, and therefore in his heart must wish them in Jericho. Perhaps there is on the part of the Government (unknown to me) some means of control over the mode in which the old honjins are kept; for otherwise one would suppose the owners' lack of interest in the matter would lead to their decay.

In this region the old honjins are in the hands of a Hakodate merchant, named Fujino, who does all the fishing and seaweed gathering this side of a point beyond Nemoro. At all the villages and hamlets his wooden warehouses are conspicuous, marked on the door with two characters that read "Mataju," by which he seems generally to be known as by a name, though it is but a sign chosen by him. On other parts of the coast the warehouses all have some other sign marked on them; some times one merchant has but one small establishment. The class of such merchants is called by the same name as is used for any government contractor, but would seem in their case to be better translated by lessee. They agree with the government to pay it a certain percentage of the fish or seaweed they take, a percentage (or excise tax), that varies from about five and a half to thirty per cent, according to the merits of the place taken, and averaging perhaps ten per cent. The arrangement seems to be just like that of leasing a coal mine. Although they seem practically to have exclusive privileges for each

place, yet it is not so far a monopoly as to prevent other merchants from coming also, if they choose, and making a like agreement with the government ; though a certain length of the shore is at the same time leased exclusively to each man. The lease is given to the first comer with-any extra payment for the privilege. The plan seems very much to facilitate the collection of the revenue, and perhaps increases its amount by placing the business in the hands of capitalists who can carry it on in a large way. Mataju's business seems to be prosperous, and new buildings are going up for him at several places, particularly at Shibets.

These lessees, besides employing the immigrant and native Japanese and Ainos, bring yearly great numbers of men from Nambu for the fishing season, Mataju for example has one or two thousand. On all the shores of Yesso perhaps tens of thousands come from Nambu every year and return for a few months to their but slightly warmer, yet native and therefore more warmly-loved region. As the herring fishery begins early they set out from home in January and are perhaps a couple of months on their way to the more distant points. They make journeys in junks that carry perhaps fifty men each, and that are fitted out with the very best of rigging. Yet owing to the storminess of the season and the fewness of harbors, there are sometimes in a single year hundreds of lives lost by the wrecking of such ships.

These facts suggest two very important considerations for the Kaitakushi. In the first place a system of telegraphic weather reports throughout Japan, connected also with the one lately begun or soon to begin in China, would enable the weather on the coast of Yesso to be predicted commonly a day or two in advance, and storm signals could be set up at different points along the

coast in the same manner as has been done for some years in Great Britain and in America. The sailing vessels then would be able to creep along with some safety from one of the few harbors to another, and at the approach of a storm could lie by until it was past. The plan also in connection with the similar work done in foreign countries would doubtless help forward very much the science of meteorology, and perhaps lead to the possibility of predicting stormy weather still longer in advance.

The other consideration is that a system of roads through the main valleys, such as I suggested last winter, would enable this large body of travellers to pass safely and cheaply to their places of work. An inexpensive road, for example, through the Ishcari valley, connecting at Sapporo with roads to Hakodate and Matsmai and at the upper part of the valley with roads across the low passes, by the Sorachi to the Tokachi, by the Aibets or the Rubeshibe to Mombets, by the Uriu to Rurumoppe, and so to the other chief points on the coast, would not only open up the island to immigrant settlers, but would render the fishery and sea-weed business much more easy and profitable; and, far more important than all, would save yearly hundreds of lives. The fishermen instead of being carried in vessels at great risk and expense and a delay of sixty days would carry themselves on foot in, say, twenty days at the expense, besides their wages, of only their food and lodging. The saving to the fishery business alone would well repay the cost of such roads; but, besides, their importance in opening up the fertile parts of the island to settlement would be extremely great. Besides the necessary hotels that would spring up along the roads there would no doubt be many a farm established to supply such points with food, and of the thousands of men yearly passing twice over the roads many would find places for a home

quite as attractive as their beloved Nambu. Moreover, according to the plan I suggested last winter of paying partly in land at a low price for the labour of making the roads, their cost would not only be reduced to a very small sum, but a considerable population might be at once secured. It is perhaps needless to say that in order to made the scheme profitable the roads, though wide enough to be passable for wagons and thoroughly well graded and skillfully laid out should be at first much less pretentious than the still more important New Road from Hakodate to Sapporo, and should be built with far greater economy than that is reputed to have been built with.

Shari; 11th September, 1874.—It might perhaps be feared by some that the practical monopoly of the chief business of whole portions of the coast by single lessees, who are as it were daimios within their own dominions, having the whole population, men, women and children dependent on them in health and in sickness, might have an unfavorable influence upon the opening up and settling of the island by crushing out individual enterprise and by lessening the profits of the original laborer. It is probable that the lessee, although he cares well for his dependents and looks out for their interest to a certain extent, yet looks out still better for his own interest; that is human nature even among the Japanese. Still, so far as a traveller through the country can perceive there is no disposition to complain on the part of the inhabitants nor any apparent ground for it; the lessee seems to be a very good daimio for them at present. They are almost wholly not only very poor but very ignorant, and, if they undertook to sell the products of their labor directly to passing merchants or indirectly to distant consumers, would probably receive still less for their labor than at present; and the greater expenses of the "middle men" would hardly justify better prices. The

fact that so many laborers are brought yearly from a great distance would seem to preclude on the part of the lessee all opposition to immigration for a long time to come at least; since the presence of more immigrant fishermen would make the cost of their kind of labor less; and if farmers came, the cost of food and consequently that of labor also would be diminished. The plan of leasing the coast therefore seems at present to have no serious objections; but perhaps to require watchfulness on the part of the Government to prevent oppression at any future time when a change of circumstances may bring temptation and opportunity of that kind to the monopolists. For example, as the payments for labor are probably made chiefly or wholly in rice, cotton, cloth, wine or other articles brought from a distance, a tendency to reckon them at too high a rate, that is, in effect to lower too much the wages, would not only discourage, immigration but make those already here wish to remove. Perhaps even the fear of falling, in respect to wages, wholly into the power of one man, not held strictly responsibe nor carefully watched by the government would of itself greatly deter immigration; for in the case of such widely extended leases removal from one man's district to another would be difficult and the fewness of the lessees would enable them to combine against the laborer. The system might also perhaps become the source of much serious harm to the public in the way of giving valuable leases to favorites merely (who in return should with their wealth strengthen the power of their favorers) instead of to the most suitable men or with strict impartiality, in case the management of the Kaitakushi should ever fall into the hands of men not strictly upright; but complete freedom of public inquiry into the facts and of public criticism on them ought to be enough to prevent such abuses on the part of government officials.

As to the collection of the revenue from the fisheries a very gratifying impression of honesty is produced by the exact knowledge of the yearly produce of each place that seems to exist everywhere, and the total absence of any effort to conceal it. Indeed the freedom with which all kinds of statistical information in regard to the staple products and to the population is given to me forms a most agreeable contrast to the childishly unwise attempts to conceal every thing of that kind that were formerly imputed to the Japanese by travellers, some of whom even mentioned that when they passed through a village the houses were all carefully closed beforehand by express order. I must confess that I have never seen even a trace of such a desire of concealment in travelling in Japan (though in the native villages of India there is a very marked unwillingness to have foreigners pass through the streets even); and I cannot but wonder whether those early travellers were not sometimes mistaken in their opinions as to what they saw and heard. As for hearing they were very dependent on interpreters, and a lack of full explanations in answer to every inquiry might have arisen very often either from the interpreter's love of his own ease or want of interest in the subject or from his inability owing to imperfect knowledge of the foreigner's language to make everything clear, at least without very great (and perhaps in his own opinion useless) effort. Even a wholly imperfect acquaintance with the Japanese language is a very great help towards gaining a knowledge of facts here; for it removes the need of boring one's interpreter always with every inquiry. Such easier intercourse clearly tends greatly to remove the possibility of many a misunderstanding, and consequently of many innocent misrepresentations of the country abroad.

In fact the very many and various advantages to the Japanese Government of facilitating communication be-

tween its foreign servants and the Japanese are so great and obvious, that in my opinion it would be well worth while to offer such servants special rewards for proficiency in the language, as the British Government does to its officials who learn the native languages of India and other allied Asiatic languages ; and I have therefore thought proper to bring the matter to the notice of the Kaitakushi by mentioning it here.

The precision with which the population, or at least the number of houses, is everywhere freely given seems to show such exact knowledge on the subject as strongly to confirm the published official census returns which could so easily be made up from adding together the different places. I am therefore almost forced to give up altogether the idea I had last year of there being in reality a much larger population, judging from the southern portion of the island alone. The yearly importation of such large numbers of Nambu laborers must also necessarily give in the summer the appearance of a much larger population than the actually permanent, counted one. Long stretches too of the more northern coast, as from Birô to Kusuri (same as Kushiro) and from Nemoro northward are comparatively poor in population, because the absence of harbors and of rocks covered with seaweed furnish less opportunity for productive labor.

As the statistics we have picked up may not be conveniently accessible to you in such detail or more exactly elsewhere, and may be of interest while you travel as it were over the ground with us, I give here a table of them up to the present time.

PLACES.	JAPANESE.				AINO.		AVERAGE YEARLY PRODUCTS, IN KOKU (ROUGHLY).				LESSEE AND REMARKS.
	HOUSES.		SOULS.		H'SES.	SOULS.					
	Native.	Immigr.	Native.	Immigr.			Kombu.	Herring Manure.	Masu.	Salmon.	
Biro		3			45		8 000	300		—	
Berufune		1									
Ohotsunai		1			2						
Shakubets		1					—	—	—	300	800 deer hides also.
Shiranuka		2		11	84	350	—	—	—	180	
Kusuri		135		528	128	581	20,000	1,000	—	500	
Kusuri Upper River		—		—	38	200					
Akashi		—		—	18	74					
Ashoro		—		—	15	93					
Kombumori		32			2		5,000	—	—	—	
Akkeshi	38	219			90		6,500	—	—	600	Mitsui (Yedo).
Hamanaka	42	—		—	—	—	2,000	9,000	—	150	Ditto, Small herrings only (konishin).
Otchishi	—	1	—		—	—	3	—	—	—	Sudzuki Shobe (Hakodate).
Nemoro	70	23			13		3,000	8,500	300	3,500	"Mataju," Fujino, (Hakodate).
Atsuushibets	—	1		140	—	—	—	200	100	350	Ditto.
Shibets	—	1		165	19	98	—	1,000	300	3,000	Do.
Bekkai	26	—	60+	—	42	140	—	1,500	200	500	Do.

Tokoro, 14th September.—The average market value of 100 koku of common kombu is perhaps about 400 rio; but a special kind, taken on the northern part of the west coast, from Rurumoppe to Soya and on the small islands opposite, and highly prized at Osaka but not sent to China, is sold at some 700 rio. The average market value of 100 koku of salmon taken in the sea is perhaps about 1,000 rio; those taken in the Ishcari River are less esteemed, have poorer flesh and a hooked nose, and are eaten at Yedo only by laborers and the poor. Sometimes 100 koku or 6,000 salmon are taken at a single haul; or even by adding to the net four sacks a good many more are taken at once. The average market value of 100 koku of masu (salmon trout?) is perhaps about 500 rio. That of 100 koku of herring manure perhaps about 700 rio.

Without knowing for each place the number of transient laborers employed and the excise paid it is impossible to calculate from the table the gross return in money for each laborer, and so to form a more precise idea of the prosperity of the business. Still, it is clear that the return is very large in proportion to the fixed population; and it seems highly probable that the net profits are on the whole very ample. The privilege of holding a lease then must be something valuable; and in consideration of that and of the fact that the public runs great risk of abuses in the case of monopolies, it seems but fair that certain special safe-guards should be exacted wherever existing agreements or the making of future leases may permit. Would it not be just to stipulate that the lessees on the one hand should pay their laborers at a certain reasonable money rate, higher of course than the average rate in the milder climate of Nippon, but perhaps having a certain ratio to that (say half as much again) and revised with reference to it by the Government from time to time? At the same time that the lessees on the other hand either should

sell nothing at all to their laborers, leaving such trade to the competition of other merchants ; or, still better, that they should furnish their laborers with supplies and goods of all kinds at say the Yedo retail price (perhaps not, however, for exportation to Nambu ?) Is it not likely that the anxiety of the laborers to return every year to Nambu arises in great part from hopes of finding there the yearly expenses of themselves and of their families much less than they would be in Yesso ; and under the proposed arrangement would they not probably find Yesso as attractive as Nambu, since the difference in climate is so trifling, and they could here live with their family the whole year round ? Perhaps they already believe in the French proverb that a man's own country is where he is well off ("ou on est bien, là est sa patrie"). On the other side, by the flowing in of permanent immigrants the expense of transporting yearly so large an army of laborers forth and back, would be removed, and the expense of the fisheries would probably be in reality far more diminished thereby than would make up for the cost of transporting the necessary supplies from Yedo, to say nothing of the difference between the wholesale and retail prices there, which would go to the profit of the lessees. The cost of such transportation, too, would be comparatively light, because it would be done by the same vessels which otherwise would come empty for the products of the fisheries. Moreover the money rate of wages would probably be much lower than it is now though giving better satisfaction to the laborer on account of the cheapness of goods. The advantage of the arrangement would not come from lessening the lessee's profits in behalf of the laborers, but chiefly from substituting for the uncertain, selfish course of unstable, irresponsible individuals the settled, impartial policy of a stable overwatching Government on whose protection

both parties could rely, and both would gain by the change.

A matter of such vital importance to the Kaitakushi, involving as it does not only almost the whole of the present business and revenue of the island but in a very great degree the prospect of future immigration and settlement, cannot be too thoroughly discussed nor too carefully considered; and that has been my reason for entering into it here at some length. Many of the considerations will apply equally to the leasing of coal mines.

On the second of September we rode from Chiraiwatara to Wakkaoi, called nine ri and a half or 23¾ miles. Some eight of those ri were in a general west-north-westerly direction rising very gradually from some 200 feet above the sea to some 1,600 feet, and were still in the valley of the Shibets river though far from the main stream; the first six ri or so over nearly flat ground and mostly through open prairies covered with low grass and low bamboo and weeds, surrounded by brush and thin light woods, with sometimes a low bank of ten feet or so on the right to a river bottom and on the left a hill of fifty or a hundred feet; the other two ri through likewise open ground with thin light woods here and there, but somewhat more broken and hilly with the road chiefly in a narrow shallow valley. The last ri and a half or so before coming to Wakkaoi were in a northerly direction through light fir woods with thick low bamboo, rapidly descending a narrow valley with high steep banks or hills on either side to the solitary honjin some four hundred feet below the highest point on the road and some 1,200 feet above the sea. About half-way between the two honjins high hills and mountains were to be seen a short distance off on the right and northward. No rocks were to be seen anywhere on the road. The heights just given, however, though suggesting some idea of the reality,

are very little to be depended on, as our barometer readings disagree so much among themselves as to show that some of them or all were very much out of order.

The road was in many places very much grown over on account of the rarity of passers ; and the whole way there was not a dwelling to be seen. About midway there was an empty resting shed, such as we have met with here and there all the way from Birô.

Mombets, 17th September.—A mile or so (half a ri) short of that resting shed we turned aside to visit some hot-springs about four miles (1½ ri) off to the right (northerly) ; but afterwards came back to nearly the same point on the main road. The springs were at two places ; the nearest, on the Paushibets branch of the Shibets ; the other half a mile (7 chô) or so northeast of that on the Shibets itself ; both places are at the same height above the sea, perhaps 900 feet. In order to reach them we rode through an open country as before, but a much more uneven one, passing around the foot of some high hills over against the before-mentioned resting shed, and crossing one or two small brooks in deep hollows ; again rising near the springs to high ground from which we had views of the sea across a flat looking or very gently uniformly-sloping, wooded country to the sea some 25 miles (10 ri) distant in an east-north-easterly direction, near the mouth of the Shibets ; and at last descending a very steep hillside, perhaps 80 feet high to the Shibets springs, having climbed up a like hill on leaving the Paushibets.

The Paushibets springs are some twenty yards easterly from the main stream (a small brook running here southerly) in a small parallel branch water course of their own at the foot of the hill just mentioned ; on the other side of the brook the slope is more gentle. They are all within a space of about 31 yards long by five wide, and are very

numerous if you count separately all the small threads of water that issue from the ground, but three of them are larger than all the rest put together. The largest discharges perhaps three-tenths of a cubic foot in a second; the next largest perhaps two-tenths; the rest all together perhaps five-tenths; making in all a discharge of perhaps one cubic foot (say eight gallons) a second, quite a small affair; yet it would be enough to supply a small bathing establishment, especially as the water is quite hot and would therefore bear mixing with cold water. The temperature at the main spring was 81½ degrees centigrade; at the next largest 75 degrees C., but here on account of shallowness the mercury could not be plunged fully into the water. The water does not tarnish silver, and so contains no sulphuretted hydrogen, and the only smell is a merely steamy one. There are many bubbles rising with the larger streams of water at their first issuing from the ground, probably bubbles of carbonic acid gas. The water leaves a slight deposit of red iron rust, but chiefly an abundant white incrustation which is perhaps mainly silica. The spring rises from a dark-gray coarse sand or fine gravel, but at one point the stream from one flows for a very little space over a gray rock. No doubt they all issue very directly from the same dark-gray trachytic rock that is exposed at the Shibets springs.

Sawaki, 18th September.—The Shibets hot-springs are at the foot of the steep hill already mentioned, on the west side of a small branch stream flowing southerly into the Shibets, which is within about a hundred and fifty yards of distance from the furthest spring, and has here a general southwesterly course; the land on the other side is nearly flat. The principal springs are five or six in number, besides a large number of smaller threads of water; and the discharge in all is perhaps a dozen gallons (1½ cubic feet) a second. The lowermost spring

is some fifteen feet up the hillside close by the Shibets itself, and yields but little, say 0.05 cubic feet a second. It issues from the soil close by some imperfectly exposed rock, undoubtedly the same as that seen better at the other springs and at a small cliff a few yards below on the river bank, a gray (weathering light-gray and buff) trachytic tufa pebble rock, with a dip of some 20 degrees N. 70 degrees W. at the cliff. A thermometer that was only partially covered with the shallow water marked 70½ degrees C. Other, cold water trickling down the hill side mingles with the hot, and both fill a bathing place hollowed out of the ground near the foot of the hill. The water is no doubt of the same character as that of the other springs. The nearest of them is about a hundred yards northward, and they all lie in one group within a space of fifty yards long north and south and, say, ten yards wide. The lowermost of them yields perhaps two-tenths of a cubic foot a second; seems to ssue from the soil at the foot of the hill; has a temperature of 82 degrees C., and like the others has a slight red deposit and a white incrustation like that of the Paushibets Springs. No doubt the water at all the springs is of the same character. The next upper spring is some ten feet higher in level; has a discharge of perhaps two-tenths of a cubic foot a second; issues from a small hole in the solid gray (bright green when freshly broken) trachytic tufa pebble rock, which just here contains some white iron pyrites (marcassite), and close by some specks of obsidian; and the temperature was 82 degrees C. with the thermometer but partially under water. Next is the largest spring of all with a discharge of perhaps three-tenths of a cubic foot a second, reinforced within a yard or so by a small spring of one-tenth of a cubic foot a second; both issue in like manner as the last from holes in the same rock; and the

temperature at the main spring is 6½ degrees C. The rock is pretty well exposed a couple of yards above on the hillside, and has a dip of 30 degrees N. 50 degrees W. It is the same gray trachytic tufa pebble rock (the pebbles of nut size) with a few small specks of obsidian. A few yards still further north is the uppermost spring, a small one, of perhaps five-hundredths of a cubic foot a second, issuing from the mud. The two or three largest springs seem to have formed a large mound of white concretionary rock on the hillside below them. Below that there are a number of holes dug in the ground to serve as bathing tubs, and are used by the Aino and Japanese frequenters of the place. One Japanese from Nemoro was at the time of our visit living solitarily here, so many leagues from any village, in the single hut that is built on the flat ground close by. The Ainos had stuck many whittling sticks about the springs, as they are wont to do at places where some specially mysterious or superior power seems to be manifested.

Sawaki; 20 Sept.—I arrived at the Wakkaoi hotel that night about six, and the last of the baggage about the same time; and my companions three-quarters of an hour later. One of the servants related that on the way he had seen a large bear only twenty yards off at one side of the road, and that it did not run away. "But did you run away?"—"Yes, indeed!" Perhaps he did not wait long enough to see whether the bear ran away or not. Probably it would have done so judging from an observation of my own. One or two ri before our first arrival at Nemoro, while riding in a narrow crooked path, I suddenly at a turn of the road met a good sized bear that was plodding along towards me with his head down, hardly ten yards distant. The horse instantly stopped, the bear looked up, saw us and immediately wheeled about and ran away. I tried to chase after him, but the horse could

be urged only a few steps forward before he stopped. He had apparently seen bears before or heard of them; or perhaps he had never even heard of them, for he showed much the same signs of fear when he first saw bullocks at Nemoro. The presence of bears and wolves in the mountains (though far less numerous than the deer) will perhaps be some hindrance to the introduction of sheep and even larger cattle; and perhaps it will be thought necessary to encourage still further their extermination by offering bounties, as is done in other countries. The Ainos make a trap for them; and on the Otopchi we saw a dozen large bows hanging on a tree that were for use in a bear trap which should shoot a volley of arrows in different directions, so as to make more sure of hitting.

The deer seem to be still quite abundant in the eastern end of the island, though less so than formerly, they say, and apparently less so than on the Ishcari waters. As we turned off the main road to go to the Shibets hot-springs we started up four or five deer that ran before us over the grassy plain.

Another interesting wild animal is a very large eagle that we saw about Nemoro, measuring some five feet from tip to tip of wings. It would let us ride very close to it on the beach, and then would fly off a short distance with its huge flabby wings. We saw many eagles of a smaller kind during our Ishcari trip as well as afterwards on the sea shore. In former times the gathering of eagles' feathers was quite a business in Eastern Yesso, it is said, and they were sold in Nippon at a high price to be used for winging arrows.

The large Nemoro eagle would be a magnificent object in our Museum and a pair ought by all means to be secured and well stuffed. It is highly desirable also in the interests of science that good and amply numerous speci-

mens of all the wild animals of Yesso, both their skins and their bones, should be taken soon and carefully preserved in that and other Museums; for as the settlement of the island advances some of the kinds will probably become extinct at no very distant day. Such specimens are so useful for scientific studies that any duplicates not wanted here could readily be exchanged in Europe and America for other similar objects, with which the Japanese Museums could therefore be enriched at comparatively small cost.

Shônai; 22nd September.—The weather had been threatening and a little rain had fallen the day of our visit to the springs; but the next morning (3rd September) it rained heavily, and continued to do so with some interruptions through the day. We therefore stayed at Wakkaoi and occupied ourselves with office work; the copying and translation of this report was begun. The next morning (4th September) we had rain again, and had begun to continue the work, when at half-past eight we learned that there was a better prospect, and within an hour we had packed up and started for Shari on the sea shore, 25½ miles (10,2 ri) distant. They said that Wakkaoi, so high up in the mountains, was a very rainy place, much more so even than a point only a couple of ri distant on our road, and that it was commonly as cloudy and threatening as when we left it; so we were glad to get away from the charmed spot in a comparatively good moment. In fact on our way it did not rain enough to speak of, and before we reached Shari it was quite fair.

The road at first kept on down the narrow valley of the day before; but at the end of a ri and a half or so, the valley had become very wide with low (ten to twenty feet high) flat-topped hills or upland, slightly-rolling ground, over which the road passed quite distant from

the brook. Several times however we came to its banks, and by noon found it a stream of perhaps a hundred cubic feet of discharge in a second. On its banks about one o'clock I reached the ruins of a resting shed about half way which had been fitted up for our passing with canvas walls and was attended by two or three Japanese and Ainos, and it was very convenient for the others, but for my part I hurried on to Shari in some expectation of rain and in hopes of getting there in time for a long rest. We passed the fallen ruins of two or three other resting sheds in the course of the day, but not a single dwelling short of Shari. From the half-way place the rest of the way to the sea shore was very level in appearance though gently descending; and the last third of it was somewhat swampy, and the road was for long distances made with split logs laid lengthwise, very slippery and fatiguing for the horse and requiring a very slow, careful gait. At length the sea was reached with its sand hills near the shore; and in a couple of miles more to the eastward I came at 4 o'clock (the rest at five and six) to the little village of Shari and crossed a ferry. The hotel had blue and white broad striped canvas hung round the fence in our honor, and we were received with the greatest ceremony and politeness, quite in the fashion of the olden time; for extremely few travellers pass along this coast, and it is therefore yet comparatively uncontaminated in respect to manners by the effect of the entrance of the foreigners into Japan.

We had hardly been five minutes on our way in the morning when we met with a small rock exposure; it seemed to be a trachytic tufa pebble rock, and contained pebbles of pumice among others; the dip was perhaps about level. Within a couple of miles we found another like exposure of like rock by the road side. Those were the only rocks we met with anywhere on the main road from Shibets to Shari.

The first quarter of the way the timber was chiefly fir and light, then gradually the firs disappeared and the hardwood grew heavier ; and about one-half of the whole distance to the sea, on the nearly level space, the timber was quite thick, heavy and fine. Then it grew lighter and thinner in the swampy ground ; and at last it became merely brush with a border of few hundred yards quite open along the sea shore.

The next morning (5 Sept.) we set out by boat for a visit to the Itashibeoni sulphur mines, a dozen ri or thirty miles, to the eastward, aside from our main course, on the north side of the peninsula already mentioned as lying to the northeast of Shibets. As there was already enough of this report written to give several days' work of translating and there was little prospect of leisure for it on our trip to the sulphur and none whatever of any other need for the interpreter's services, I of course left him behind at Shari, saving thereby the wholly useless labor and expense of his going with us. On such a journey any addition to the party is an encumbrance that must be compensated by some special usefulness ; and in this case it turned out for all concerned particularly fortunate, in the matter of carriage, that our number was no greater. Although we also left most of our baggage at Shari, we afterwards found that we would better have left still more ; but we thought a trifle more or less in the boat would make no difference, while it might add very much to our convenience.

We and our luggage and food in that way were reduced enough in compass to go all in one boat ; but that was a rather large one (40 koku, say 6½ tons) in order the letter to ride out the waves in case of heavy weather. It was manned by two Japanese boatmen and ten Ainos, three of them young women, for in these parts the Aino women seem to work in

just the same way as the men. Nine of the Ainos each with one oar rowed in the fore-part of the boat and one Aino at the stern steered; the two Japanese superintended. When we had everything ready for starting we were told to wait a while for the tide to rise enough to take us over the bar at the mouth of the river; and we finally left the hotel a little before ten. We had rowed hardly a quarter of a mile when we were aground on the bar, and though the whole crew jumped into the water and pulled and pushed with might and main we could not stir. It was not to be high tide until two o'clock; so, after a good trial of strength, a messenger was sent back for a smaller boat to lighten us. It came soon, rowed by some Ainos, three of them again young women; and when they had taken us passengers and part of the freight, and had joined their forces to those of our own crew, the big boat was at length moved over the bar; and we boarded her again, and fairly started about half-past eleven.

The water was very smooth and the wind though not with us was very light, and by rowing steadily we had at a quarter-past-four reached Horotomari, only three ri as we were disappointed to learn. Still the boatmen, who had hardly yet attained to our exalted idea of the great value of time, wished us to stop here for the night as there would be no place nearly so good beyond that we could reach, and the morning breeze from the land would take us along quickly enough to make up. So we greenly enough consented on condition of their starting very early. We were lodged in the small "banya" or manager's house which, with a storehouse and two or three Ainos' houses, make up the hamlet.

"Banya" means literally watch-house, or still more literally turn-house, that is a house where one or another by *turns* keeps constant watch or oversight, and it is the name given to the houses all along the coast, one at

almost every hamlet, where the fishing business is superintended or managed. Sometimes such houses serve as a hotel, there being no other so suitable; and at the more important points the old honjins generally, if not always, seem really to serve as banya also. Even in very small places, then, there is the possibility of lodging in a banya, which however poor is sure to have one or two small rooms or corners of the huge common room that are furnished with clean mats, and are therefore very comfortable, decidedly more so than a tent; which on the other hand is much pleasanter than the vile accommodations to be found in the backwoods of some other parts of the world. The unfinished walls of my room at the banya were hung round with blue and white broad-striped canvas, which reminded me of the custom of our ancestors three hundred years ago of hanging arras round the best rooms. Nevertheless, some assert that our modern custom of pasting paper on the wall instead of such hangings was brought to Europe from Japan a couple of hundred years ago.

Chietomai, 24th September.—The next morning (6th September), the weather was still fair and the water smooth, matters of such importance that we kept on our journey, although it was Sunday and we needed rest. It was half past six by the time we started, and as the promised favorable breeze was lacking the rowing was continued. At the end of an hour and a half, however, the big mast was set up and a large tattered sail of matting was hoisted; and the rowers rested for an hour. The breeze then dropped down and the rest of our boat journey was made with rowing.

The land as far as Horotomari had been low with a wide sand beach and a bluff, the first half of the way perhaps twenty feet high and the other half fifty; and with a view of Sharidake, evidently an old volcano,

perhaps 2,500 feet high, a short distance back. But very quickly after leaving Horotomari the land near the shore grew hilly, higher and higher, up to 300 feet or more, and the sand of the beach was replaced by blocks of stone. Further back was a range of mountains with two or three high pointed peaks. The hills along the shore grew more and more rocky, until at the end of three hours we were under high beetling cliffs of dark-gray volcanic columnar rock. Rounding a point there we passed the little banya of Ushiungushi at the head of a cove, three ri by the mountain road and four and a half by sea from Horotomari. Then the pebble beach was renewed for a space with less rocky hills behind ; but soon we came again to cliffs a hundred feet high made up of just such greenish-gray tufa pebble rock as we saw last year near the Kayanoma coal field. Such cliffs were repeated here and there until we reached Utorutsukushi, about six ri from Horotomari, soon after even. There we stopped an hour to take aboard a windlass for hauling our boat ashore, and to give the Ainos a chance to cook and eat their lunch. There were a couple of Aino houses there ; but all were empty, as the salmon fishing had not begun. The rock of the cliffs proved to be a dark-gray cellular (no doubt trachytic) volcanic rock with steep cliffs and a south-easterly strike. Up to this point there is (as it turned out) a rough mountain road to Horotomari, and thence along the sea shore to Shari, and there would be no difficulty in making one all the way along the shore except for some 500 yards of cliffs without reefs below near Ushiungushi and for the rather large blocks of stone on the beach in some other parts.

We were off again before half-past twelve and in about a mile passed the old banya of Horobets on a long beach ; then rowed under high cliffs of dark-gray volcanic rock with big caverns until we reached Yuwōbets, eighteen

miles and three-quarters (7½ ri) from Horotomari, at 2 o'clock. Here again the boatmen insisted that we would better stop; for a brisk breeze had arisen, and they said, as there was no other chance to land for a couple of ri, we might get blown out to sea. The navigation along this exposed harborless part of the coast is so uncertain that the best weather of all is considered to be a perfect calm so as to admit of rowing to the best advantage; a land breeze blows out to sea, a sea breeze makes the water too rough. So we pitched our tents with some difficulty in the wind on the beach; for there were no houses. The gale rose in the afternoon and night so that the tents could scarcely be kept from blowing away by fastening them to numbers of heavy stones.

The next morning (7th September), the wind was still so violent that we removed the tents a couple of hundred yards along the shore to the shelter of some cliffs, where there was found also a fine spring of water. The rock was a dark-gray trachytic porphyry with many crystals of glassy feldspar (sanidin) and some grains of pyroxene (or possibly amphibole) and a few minute grains of magnetic iron ore. The sanidin was in some places tinged red so as to give a reddish color to the beds of rock. The dip was 55 degrees S. 50 degrees W.

About noon the wind died away, and after lunch our boat was launched, and we started again about half-past one. We rowed to Kamuibets in two hours, all the way under very high cliffs of gray volcanic (trachytic ?) rock, except the last mile which was along a stony beach under a grassy bluff of light-brown gravel of some fifty feet in height. The cliffs were sometimes cavernous; and sometimes were blotched with deposits of a white substance, which was probably native alum (kalinite); for some days afterwards near Awashiri we found what appeared to be the same thing in an accessible place.

Kamuibets, a brook half-a-mile beyond the somewhat larger Itashibeoni brook, was the end of our boat journey towards the sulphur, and as it was declared by our Aino guide to be impossible to pitch our tents anywhere on our way from the seashore to the mines, we pitched them at once, and the boat was hauled ashore by five o'clock.

The rocks here were still trachytic ; and we were told that only similar rocks, volcanic by the description given, and as seemed otherwise almost certain, were to be found along the coast all round the promontory to Shibets ; but that they were somewhat reddish near the end of the point. There would clearly be no need of prolonging this tediously slow voyage for the sake of verifying the volcanic character of the rocks beyond the sulphur. The distance from Kamuibets to the end of the Cape is called five ri.

Soya, 25th September.—The next morning (8th September) before half-past six Mr. Akiyama and I set out on foot for the sulphur mines, called two ri distant, accompanied by the two Japanese coolies to help in surveying and by two Ainos (one of them the guide) carrying four meals of cooked food and blankets, so that if necessary for finishing the surveying we might bivouac near the sulphur. The Ainos also carried two Japanese jugs of water ; for we soon left the stream of the Kamuibets and climbed the hill to the east. The sulphur is in a small valley parallel to the Kamuibets and not far from the sea, but the lower part of that valley is inaccessible from the sea shore on account of high cliffs. We had not climbed far in the hills before the guide lost his way, as the path was much grown over and he had not been there for a long time. After a fatiguing walk across ridges and ravines and through brush we came out, however, at length on the sulphur brook at the bottom of a deep narrow steep-sided valley. The sight of a fine stream

of clear water was most welcome to us in our thirst, and we stooped eagerly to drink; but the water was as sour as vinegar, evidently with sulphuric acid, and drinking was out of the question. Our expectation too of finding drinkable water beyond was here destroyed, and I began to regret the freedom with which I had already let myself be indulged with the water of one of the jugs; when all at once crack! smash went the other full jug, as the guide rested his burden against a big stone. Drinking water immediately rose in value almost to its weight in gold, and we saw that we must economise. We toiled up the rocky channel of the brook in a southerly direction, three or four times climbing round or over waterfalls from fifteen to thirty feet high, passing some hot springs and some cold springs, all sour, and at length reaching a small branch valley on our left near the head of which was the sulphur. But even above the branch the main stream was undrinkably sour. The climbing now became still steeper, but the footing easier; and at last by half-past eleven we reached the lower end of the sulphur some 1,700 feet above the sea. We saw at once that the surveying could be despatched easily in time to return to camp the same day. We left our loads, and with our lunch walked on up the hill and over the sulphur to a place sheltered from the strong cold wind on the further side of the ridge to the top of which the sulphur reaches.

On the way up we looked with astonishment and admiration on the source from which the sulphur comes. It is a large hole in the midst of the deposit, about one-third of the way down from the top, and is perhaps a hundred feet in diameter and thirty feet deep, and at the bottom has a smaller hole, perhaps twenty feet long and fifteen feet wide. The smaller hole is full to within perhaps five feet of its brim with a dark brownish-gray,

muddy-looking liquid which is boiling violently and spouting upwards for several feet in great commotion, and sending out heavy fumes of sulphur that hide the view much of the time. The liquid would appear to be nothing but melted sulphur ; in the whole branch valley there was no water to be seen. Moreover, water could not exist at that temperature in such a place without quickly turning to steam and disappearing ; and no steam is noticeable in the fumes. They, on rising from the hole, are blown sometimes one way and sometimes another, and have dropped powdery sulphur all about within a space of somewhat rectangular shape about 250 yards long from top to bottom and 150 yards wide across the valley, which here is broad and shallow and slopes steeply westward falling about 325 feet from top to bottom of the sulphur. There are no plants here and the ground is covered with rough blocks of stone one foot, two feet or even six feet or more in diameter, a gray volcanic rock, trachytic porphyry, containing sanidin. Among these stones the sulphur has gathered to irregular depths, in some hollows quite covering the stones, like a snow drift. In some places the sulphur is burning quietly at a depth of a few inches below its surface and sending out fumes by small holes. Further down hill the sulphur has been washed by the rains down the bed of the stream now dry, and has collected into a solid, pretty pure mass a foot or two or even three in thickness, but only a few feet wide though perhaps a hundred yards long. The whole space covered, wholly or partially by the sulphur, is about eight acres (9,600 tsubo), and the average thickness we estimated to be perhaps half-a-foot of pure sulphur, hardly more than that, perhaps less. That would give 3,200 cubic yards of sulphur powder, or say 3,200 tons (20,000 koku), which at Hakodate would bring (at 300 riyo the hundred koku) 60,000 riyo.

The place was worked in the summer half of the year for a year and a-half and was abandoned in 1867, they told us. The sulphur unrefined (in the absence of fuel and furnaces at the mines) was carried on the backs of men, five kamme or 42 pounds to each man, down the steep, rocky, slippery brook and over the hills to Kamuibets, where there was a house. The men made one trip a day, going to the sulphur, digging it and returning; for there was no lodging at the mines and water had to be carried as in our case. The cost of carriage was so high that the work was given up. Very flattering accounts of the place were given us last winter at Yedo, and a visit to it appeared to be quite indispensable. It seems, indeed, to be much the richest volcanic sulphur place in Yesso, and although the gross value of the sulphur is not large and would be in great part eaten up by the cost of working and of bringing to Hadodate in vessels that would have little or no return freight, yet a small economical working might perhaps pay a little profit. The carriage to the sea shore could be made much easier by placing a few ladders at the water-falls, and perhaps by setting up a hoisting apparatus at the cliffs on the sea shore at the mouth of the sulphur brook; or the sulphur could be carried over the hills by horses. The experiment might easily be tried of dipping out the sulphur from the big boiling cauldron by means of a long wooden ladle or a bucket at the end of a long piece of timber worked somewhat like a dredging machine, or perhaps by means of a pump. It is impossible to say how long the supply would last in that case; but it seems likely that it would be immense, since the portion that falls on the ground must be only a small part of what rises in fumes from the hole and that must be little compared with the quantity below. To what depth it reaches can only be judged by the apparently great heat, perhaps several

miles, though very likely not all the way down so regular in shape as at the top nor exactly vertical, but splitting up into irregular fissures. On removing sulphur from the top the remainder would probably be forced up from below to the same level. For every thousand feet of depth there would be some 13,000 tons (80,000 koku) of sulphur; for every mile of depth, 68,500 tons (420,000 koku). How large the reservoir of sulphur below may be it is of course quite impossible to tell.

Tomamai, 1st October.—We ate our lunch on the leeward hill side, and tried several small basins of rain-water that had gathered on the hollow top of large blocks of stone; but all, even at several hundred yards distance from the sulphur and so sheltered from its influence, were too sour to drink with pleasure. After a little rest we made with prismatic compasses and aneroids a rough survey of the limits of the sulphur deposit, Mr. Akiyama taking one side and I the other. Then, after packing up some small samples of the sulphur and of the rock, we set out for the camp again.

Near the lower edge of the sulphur were some stunted five-leaved pines, the same that we found at the Kaitaku-toge between the Ishcari and the Otopchi; perhaps, however, not exactly the same as our American five-leaved, white pine. But we took especial interest in the white checker-berry that grew in such abundance all the way for several hundred yards downwards from the sulphur that you could in many places strip off by the handful the delicious, spicy, firm, but not very juicy berries. We had eaten some of them on the way up, but feasted on them still more freely on the way down and carried some to camp. They are larger than our American checker-berry, have more flavor and are on the whole decidedly superior to it. It is quite curious that we have found the white berry in Yesso at two or three other places, at Iwaonobori

(near Iwanai), at Nuburibets and at Esan; at every place near a deposit of sulphur. At first I supposed its rarity, (even the Ainos are unaware that it is eatable), was due to its growing only at very great heights; but at at Nuburibets it was abundant at only some 900 feet above the sea, and below the Itashibeoni sulphur it was found here and there at even a lower level perhaps. We have climbed many other mountains to a greater height, but have never found it without sulphur in its neighborhood. It seems then to be favored in its growth by the acid sulphur fumes or water; or else possibly less injured by them than the other plants with which it has had to struggle for existence and which, with such aid, it has been able to withstand. At Iwaonobori we found also a red checker-berry, juicier but softer and less highly flavored than the white, and hardly superior to our American kind, which it resembles in color.

At about a quarter of a mile below the lower end of the sulphur and perhaps thirty yards below the mouth of the small branch valley, and at about 1,250 feet above the sea is the uppermost and largest of the hot-springs that we saw. It discharges perhaps two cubic feet (say 16 gallons) a second, pouring out of the gray volcanic rock. The water is very sour and very hot and steams strongly. Without a thermometer we guessed the temperature to be 80 degrees C. About fifty yards below that is a much smaller, but still hot and sour spring issuing in like manner from the rock. Again about twenty-five yards below that is another small sour spring with a discharge of perhaps one cubic foot a second, not quite so hot, perhaps 50 degrees C. No gas bubbles nor concretionary deposits nor white sulphur nor iron rust were noticed in connection with any of the springs. Along here the brook flows over solid rock for a hundred yards together; but the dip is difficult to make out; it seemed to be perhaps 45 degrees

N. 50 degrees W. At the point where we finally left the sulphur brook, about three-quarters of a mile from the sulphur and perhaps a quarter of a mile from the sea and about 450 feet above the sea level, there was a large cold spring with a discharge of perhaps three cubic feet a second ; it was also sour, to our great disappointment.

On our way back over the hills we succeeded in following the old road almost all the way and found it much easier walking ; and we reached camp about half past five. I counted my steps ; and found the distance from the sulphur to the mouth of the Kamuibets to be about two miles, or 30 chô, instead of the two ri it had been called.

Half a mile after leaving the sulphur brook we found in the dry bed of a rivulet about 450 feet above the sea an exposure of dark gray volcanic rock that dipped some 20 degrees N. 50 degrees E. The highest points we passed over were about 550 feet and 700 feet above the sea.

The woods which began with small brush near the mouth of the small branch valley of the sulphur brook were continuous the rest of the way until close by the sea shore ; but though larger at a greater distance from the sulphur and at a lower level were throughout only light woods.

The next morning (9th September) the sea was pronounced quite too heavy for our navigating powers ; and it was wholly uncertain how many days we might have to wait for satisfactory weather. So I suggested a return by land on foot ; judging by the real length of the reported two ri to the sulphur mines I thought we could probably reach Utorutsukushi the first day and Shari the next. As we had at starting from Shari planned for no such emergency it was for a while questionable whether we could carry our luggage and enough food. After some consultation and cipher-

ing we found it possible to leave one sick Aino and one of the Japanese boatmen and the large coolie tent and some superfluities behind with the boat, and to carry with the rest of the Ainos and our two coolies all our baggage and three days' food; and we therefore began at once to strike the tents and pack up. It was a long time before all the loads were finally adjusted, and almost every one of them was a very heavy one (in fact too heavy); and we did not really start until about half-past nine. The first mile along the sea shore, though rough with blocks of stones, was comparatively easy, though requiring a long rest at the end of it for the loaded men and women. But then began the difficulties of the journey with climbing the steep hill to avoid the cliffs a'ong the shore.

The height of the hills was much greater than it had seemed from the sea, and we passed over summits first of five hundred feet and afterwards of seven hundred feet in height above the sea; but without descending deeply into hollows between. As none of the party had even in hunting been over the ground before we did not go as directly as might otherwise have been the case; but went winding about, pushing with might and main through bamboo thickets and swampy ground, or turning aside to avoid them. Sometimes we came near to the sea shore in hopes of seeing some sign of Yuwôbets, but were long disappointed. We had to stop very often indeed to rest on account of the great weight of the loads and the roughness of the ground. Instead of lunching at Yuwôbets, as I had hoped, we arrived there with great difficulty at nightfall, nearly seven o'clock, and almost worn out with fatigue. Nevertheless I had by counting the steps found the distance (though much more than I had conjectured) to be but about two ri and a-half; by sea probably two ri. By that and our

other experiences of this year where I have found the distance by counting my steps, I am satisfied that such walking in the woods without a path is about four times as difficult as walking the same distance on a good smooth wide road.

We pitched our camp in our old, first place on the beach and the Ainos in the absence of the big tent had an empty Aino house not far back to resort to, not fancying the shelter of the overhanging rocks which seemed to me quite as good as a tent. But our servants and coolies, like the Ainos, seemed even in the warm summer to prefer to sleep in a tent that was shut up as closely as possible, though crowded. We were glad to eat our suppers as fast as the single kettle we had brought could cook the rice.

The next day (10th September) the single kettle could not let us start before eight, but then we pushed on and climbed to the top of the high land above the cliffs. The hills, however, were lower to-day, only 320 feet, 450 feet and 420 feet high, and not very deep hollows between. We also had for a time a hunter's blazed path, and our own men knew the ground here better. About noon we had reached (in about a ri) the mouth of the Horobets a stream of perhaps a hundred cubic feet of discharge in a second; and there we lunched in sight of Utorusukushi a mile and a-half distant along the beach. We were rejoiced also to see that in our absence some boats had come there to begin the salmon fishing; and we could make the rest of the journey by sea as the water had become smooth. In fact we quickly reached the Banya there, four miles (1.6 ri) by my steps from Yuwōbets, say a ri and a-half by sea. They told us that we should probably have been at least a day later if we had waited to come by water; so we had for our pains the gratification of having saved so much time.

The boats had come only two days before and the first net was to be cast that night. We were furnished with a boat smaller than our other one, and with our Japanese boatmen and five Aino rowers, all men, we started once more on the water before 3 o'clock. The other Ainos were to go back for the big boat as it was wanted as soon as possible for the fishing. About half-past five we reached the Aino village of Onnebets, half a dozen houses, and pitched our tents on the beach there, just across the brook. A young Aino at once waded over to us hospitably with a burning brand to light our fires. Two or three of the older men of the village also came to help in pitching the camp and to make their salutations. One man was sent off to Shari to bespeak horses for our journey beyond, and if possible to have them come out to meet us, as they could go quicker than the boat.

The houses of Onnebets had the peculiarity of a rude kind of chimney, a grass-built enclosure four or five feet high round the large smoke opening in the roof. The introduction of the art of building chimneys seems to be highly important to the comfort of the inhabitants of Yesso, and consequently to its popularity as the destination of Japanese emigrants, and to its rapid settlement. Although wood is much burned even in the main room of the hotels instead of charcoal, there is no chimney, and the smoke escapes by a great hole in the roof, which must also let all the warm air escape at the same time; or if somewhat closed must let the room fill with smoke. The upper part of the room is always black with soot. Even the large chimneys common in American backwoods, built rudely of stone or still more simply of logs and mud, must be a source of greater warmth and comfort than the system in use here.

The next morning (11th September) the water was smooth with little or no wind and we were off before

seven. In an hour and a-half we passed an Aino on the beach who said the horses were coming out to meet us, and not long after on rounding a point we descried them in the far distance, a welcome sight. We reached Horotomari (three ri from Onnebets) within half an hour after their arrival and in less than fifteen minutes had started again on horseback, before 10 o'clock. With a good level road, most of the way on a hard beach, we arrived at Shari long before noon. But the baggage came later, and we could not set out that day northwestward.

The Ainos also arrived in the afternoon and were paid off in the hotel yard with goods of various kinds, rice, cotton-cloth and the like. Two or three shy women, strangers to us, came to take certain portions of the pay probably on behalf of those we had left behind. Before those who had been with us went away they came in front of my door to make their parting salutations in Aino fashion, but somewhat abbreviated from the manner we had witnessed on the Ishcari. There two Ainos on making acquaintance for the first time would squat opposite each other on the ground and looking at each other with very grave faces would rub each his own hands three times slowly back and forth, then would make each one with both hands open three motions from near the ground half way towards his own chin, then three similar higher motions so as quite to stroke the beard, sometimes winding up with a movement as if putting aside the earlocks. Then the eyes would wander away from the fixed gaze and the new-comer was ready for the salutation of somebody else. There seemed commonly to be no eager entrance into conversation immediately after the ceremony, no inquiries after health or news. In merely passing a strange Aino on the river or on the road, even if some inquiries were interchanged, there was no such elaborate form gone through, indeed apparently none at all.

Tomamai; 2nd October—As regards the Ainos anything whatever, even though it may seem by itself to be altogether trivial, still if it directly or indirectly tends in the slightest degree to elucidate their origin and affinity with other races, their mental and bodily characteristics, is both of great interest to ethnological science and especially of much importance to the Kaitakushi, which has in its hands not only in a great measure their present welfare but the privilege of beginning their future civilization and enlightenment. I shall therefore take pains to record from time to time somewhat minutely (as I have done in former letters) what I have been able to observe or to learn in respect to their natural history, their customs and their character.

In regard to their hair some travellers have thought it seemed finer and blacker than the Japanese; and others, coarser. But an occurrence in a dish served me at dinner at Wakkaoi led me to make a microscopic comparison of the hair of my two Japanese servants and of three Ainos who were then with us. All three Ainos had hair of about the same thickness, and in that respect came between the two servants' hair, differing but little from either. All five samples were quite black except one of the Ainos' which had a faded brownish appearance. All were very much thicker than the only hair of European origin (my own) with which I could compare them. One of the servants' hair was slightly curly or wavy; some of the Ainos have it very much so. One we had in the early part of our Ishcari trip had hair and beard almost as wavy as those of a mulatto. The eldest of the three Aino women on our sulphur excursion also had very wavy hair which consequently stood out in all directions from her head in the most striking manner. Since leaving the Tokachi (in the same way as I remarked before

that) we have met with a great number of cases of bald, or partially bald, Ainos, often quite young, evidently the result of some common disease of the scalp.

All three of the young women on our sulphur trip wore no band round their head to confine the hair as the men commonly did; but went quite bare-headed; and the hair was cut square off just above the shoulders. The two women with straight hair had it parted, as customary with the Ainos, in the middle, and it hung down smoothly without any mop-like appearance more than is usual with the Ainos.

In the statement I sent you of the measurement of the dimensions of our Ainos at Ôhotsunai you noticed no doubt with regret the lack of such information in regard to the other sex, and you may think perhaps that I was able to supply the defect at Shari. But leaving the young women behind so unexpectedly on our way back was itself enough to prevent so desirable an investigation, even though they had been willing to permit it. It was noticeable that when all our crew jumped into the river when we were trying to cross the bar, the men all stripped to their waist cloth, while the women only replaced an outer garment (which they wished to keep dry) by another coarser one, disclosing in doing so an inner, thin, dirty, blue figured cotton loose garment of like shape as all the other Aino clothes; and that inner one was not removed at all. It is plain then that among Aino women there exists the desire to conceal the greater part of the body.

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The three Aino women of our boat crew, though, as you might expect, without much refinement, seemed to be of respectable character enough. Without being handsome, as one or two of the men really were in a remarkable degree, they yet shared to some extent the good looks

that are so far from being rare among their race. The youngest was perhaps eighteen and was called by the other Ainos "girl" (musume), and was probably unmarried. She was a "gay and happy" lass whose frequent laughter became her well. The other two were married women, the younger (perhaps twenty) with a slightly haughty or disdainful expression of face, the other (perhaps twenty-five) with a rather broken-spirited one; though both were not wanting in laughter. It was the last mentioned who had the singular head of hair, which by its seeming neglect of appearances rather added to the effect of her disheartened looks. Although probably still young she had begun already to have the features of age.

The women rowed industriously, were always ready at their post, and shouldered their burdens on the march without the least sign of complaint. They carried enormous loads, though not so strong as some of the men nor so tall as any of them. During the foot journey I asked if such exhausting work did not prevent their bearing children, and was answered that the younger married woman was just then pretty far advanced in the family-way. Not much special consideration for the women was shown by the men while at work; but still now and then a little, such as might pass for a trace of gallantry, possibly brotherly or fatherly kindness towards a weaker relative.

The men of our party showed no striking peculiarities beyond what I have previously remarked concerning the Ainos. As we approached Ushiungushi the first time we met a smaller boat with two or three Ainos, and they furnished our crew with some fresh fish, about half a dozen large masu (salmon trout?). In return our men handed over in a cloth perhaps three pints of boiled rice, small compensation as it seemed. No bargain

seemed to be made but the fishermen looked well satisfied. In travelling with the Ainos and passing Aino houses and villages, I have never been able to notice any special display of hospitality, no invitations to our Ainos to enter and share the food, drink or other good things of the householders. On the other hand the impression has been produced that a strange Aino in passing was considered quite at liberty to help himself to whatever he stood in need of. Still on our first visiting Yuwôbets the Ainos seemed scrupulously to abstain from entering the unoccupied Aino house near by and from using any of its furniture; and I am not sure but that they did so even on our second visit though without their tent.

While the Ainos were rowing singing was constantly kept up in much the same manner as we have seen elsewhere. The songs consist of but a few syllables, each say half a dozen, which are repeated over and over again in different keys and manners for ten or fifteen minutes together. Then some one of the crew interrupting will strike up another song and tune and the rest all join with him. Sometimes they divide into two sets of voices, one singing the short song and the other repeating it in just the same manner, or else singing another part or answer to the same song. In our boat the women or sometimes one woman would sing one part in a shrill, cracked voice and the men would sing the other. Last year I was told that these songs had sometimes no meaning, were simply refrains like our "tirala;" but on this trip the meaning of one of the favorite and most frequent songs was given to me. It was a short invocation of a god of wealth or happiness. Strange that these poor creatures, the very pictures of hopeless poverty you would say, should spend so large a portion of their lives in calling on the god of wealth!

Happiness, however, is not by any means wholly wanting to them with their gay and cheerful disposition. As to their habit of langhing, on the occasion of anything whatever that seems striking to them, a good illustration, quite parallel to the one given by Wallace in his account of the Papuans, was witnessed by me the morning of my arrival at Bekkai. I had come alone and, having arrived unexpectedly soon, asked a Japanese boy on the ferry boat if that was Bekkai. The Aino man at the other end of the boat instantly ducked his head with a quick movement; and with difficulty suppressed evidently a roar of laughter, at the idea that any body should not recognise Bekkai at first sight, a place he had known his whole life long. The incident was well worth the whole morning's ride; and was owing to the fact of my being without companions.

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It was worth a day's ride to see the flash of the eye and the warmth with which a certain landlord from Nambu answered my question whether that was a better country than this. He did not seem to lay so much stress on the greater mildness of the climate there; evidently there is still something for the Kaitakushi to do in making Yesso attractive, either by increasing its population, or possibly in still other ways.

Tomamai, 3rd October.—On the 12th of September, we rode to Awashiri, twenty-three miles and three-quarters (9½ ri). The first two-thirds of the way were over a nearly straight, monotonous, sand beach, hard and very easy for riding, bordered by irregularly-shaped grassy sand hills, twenty feet or so in height with woods, apparently light, some distance back, and with only one Aino house on the way. Then came a ferry and a small village of a dozen houses, almost all Aino houses; and from that onward still a good beach road, but on the

left land some twenty-five feet high with a grassy bluff towards the sea, and with light-looking woods back. The bluff gradually grew higher to forty feet and the land more broken and the shore less straight, forming a cove where a banya and several store-houses were placed, and already eight or ten Ainos' house had been passed. Then the shore was strewn with blocks of dark-gray trachytic rock which also formed reefs in the water; and at length, half a mile before reaching Awashiri, we met with a high, light-gray cliff that cut off the beach road and obliged us to climb over a flat-topped hill, perhaps a hundred feet high, to the village at its foot on the other side, by the mouth of a wide river of perhaps 150 cubic feet of discharge in a second.

The cliff is made up of light-gray trachytic porphyry, with a very light-gray paste and with numerous very small sanidin crystals and many long (0,02 foot) slim crystals of dark greenish-black hornblende. The rock is broken up into short columns half a foot to a foot in diameter which are very confusedly mixed in direction and often bent, but in general are inclined, say 60 degrees about north-east.

There is an island perhaps 60 feet high apparently of the same rock in the sea opposite the village and perhaps half a mile distant. The rock is light-gray, is an irregular mass of short columns, and forms a cliff on all sides. The top is rounded and below is a wide reef all about, so that the outline, as sketched from one side at low tide, looks like that of an old slouch hat with a broad brim.

The village is small with a government office, a score of Aino houses, a half dozen store-houses and an admirably clean, fresh-looking hotel.

The 13th of September was Sunday, and the temptation was strong to stay in so comfortable a place, and besides,

smaller amounts of it here and there all the way from Shari to Sôya.

In the night a heavy easterly rain storm set in that obliged us to stay at Tokoro over the 14th of September. The rain leaked so badly into my room as to make it quite untenable; but my companions, with their usual thoughtful consideration, gave up their room to me. We spent the day in report writing and copying, in translating and in plotting the Itashibeoni survey.

The village seemed to be but three or four Aino houses besides the hotel, which was but a small one.

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Tomamai; 4th October.—On the 15th of September the weather was fair again,' and we rode to Yūbets, 24 miles (9,6 ri).

After riding for a ri or more along the sea shore, but chiefly behind a single or double barrier of irregular wind blown but now grass-covered sand hills sometimes as much as fifty feet high, we reached a river with a narrow outlet but widening above to a large lake. On our left had been thick low oaks with taller but apparently light woods behind. We crossed by a ferry a few hundred yards above the mouth and kept on the lake side of the narrow bar of sand between us and the sea. The bar rose in the middle of its breadth into irregular, grassy sand hills, and after a little distance becoming wider was covered in great part by a thick growth of dwarf oaks. We rode some ten miles (4 ri) along the shore of the lake, which at the widest place is about two ri and a-half wide. Although the river was said to be but ten feet deep at the ferry, the lake was reported as 120 to 180 feet (20 to 30 ken) deep. As the point where we finally (still at a wide part of the lake) crossed the bar to the sea shore the width was only some fifty yards and the height some twenty-five feet. It would be an

excellent place to make an artificial harbor, if the needs of commerce should ever require one on that coast so destitute even of places of refuge for vessels passing in doubtful or bad weather. The place was closely similar to some that I have seen on the coast of Cape Breton, in regard to one of which a report as to its capabilities for becoming a harbor was written by my friend Mr. J. C. Trautwine, so celebrated in such engineering matters. If I remember rightly the cost in that case of cutting through the bar and protecting its sides and the long projecting seaward entrance with wooden piles was estimated at something less than one hundred thousand dollars; the cost of building with stone somewhat greater, but for permanent work probably cheaper in the end, owing to the depredations of the ship worm on wood placed in sea water. His plan was never fully adopted, but a much cheaper, less serviceable work was carried out and a harbor made. But in our case here the difficulty would be even less because the bar is narrower and the water on either side apparently bolder, so that the cutting and the length to be protected would be shorter. The lake too is so large and deep as to leave no fear of its silting up for a very long period. As far as ease of construction is concerned, it is much the best place for an artificial harbor that we saw on that coast; although there are two or three smaller similar old bays or coves now closed by a sand bar on the seaward side. Still although smaller and shallower than this one they may at some future day be worth opening, when the population and business prospects or naval requirements of the island seem to demand it.

After leaving the lake we rode through the same country of irregularly shaped grassy sand hills up to thirty feet high along the sea shore; with lower ground behind and with dwarf oaks beginning a few hundred yards back

followed apparently by light woods behind. At last we reached the hotel and three or four Aino houses that make up the hamlet of Yubets, close by the sea shore. We had passed scarcely a house on the way, one or two at the ferry, and half-way by the lake side a resting house fitted up for our accommodation. The others stopped to lunch there and arrived at Yubets three hours after me.

Not a rock was seen the whole way; but the coarse sand of the beach at Yubets still seemed to come wholly from volcanic dark-gray trachytic rocks. There were many pebbles to be sure of blackish quartzite, but we have found them to be enclosed very often in the trachytic rocks; and since that have found tufaceous pebble rocks containing large quantities of such quartzite, the same blackish stone that we found in such abundance on the upper Ishcari. On inquiry at Yūbets we learned that no such black rock was to be found in the high picturesque mountains that we saw across the big lake, but that the rocks there were white and light-gray like those of Awashiri and by the description evidently volcanic rocks, probably trachytic porphyry.

The 16th of September on leaving Yūbets for Mombets, 16½ miles (6,6 ri) distant, we crossed almost at once a ferry of some fifty yards, and kept on along the sea shore, still among low sand hills and with low flat ground back and with light-looking woods half a mile from the shore. At the end of a couple of miles we rode for half a mile or more along a narrow sand bar that separates from the sea a large lake that reaches back perhaps a mile. In a few hundred yards we came to another such lake reaching perhaps even twice as far back and perhaps a ri along the sea, separated from it in like manner by a bar only about eight, six or at one place even four feet high and quite narrow. Beyond that still on the beach or on the sandy

grass-covered upland some twenty feet high close by with low woods 150 to 300 yards further back we rode all the way to Mombets, passing a village of three or four Aino houses a couple of miles before arriving there. For the last two-thirds of the way it had been raining gently, and the late comers had still more of it ; for it was rainy all the rest of the day.

Mombets is an important place as the capital of the province of Kitami, which extends all along the northeast coast from east of Shari to near Esashi ; but the village although having a government office, a very good hotel and some storehouses, seems to consist otherwise only of a dozen or twenty Aino houses.

As the day's journey had been short we worked in the afternoon in copying and translating this report.

It rained heavily in the night and a little the next morning (17th September), and looked so threatening that we did not leave Mombets ; but spent the day in office work. I drew in pencil the latitude and longitude lines of a small map of Yesso on which I hope to be able by the time of our return to Yedo to lay down the geology and topography of the whole island, in great part conjecturally, to be sure, but still so as to give a very useful idea of the real facts. Mr. Akiyama began work at once on the outline so given, and as leisure offers is reducing upon it, at one half the scale, the map which our geological assistants made last winter from Matsura's large map, and of which you have a copy. I also did some report writing and the translation was continued.

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Herashibetsubuto ; 5th October.—Horses are so rare in the northern part of Yesso that we had to keep the same ones for our baggage from Shari to Esashi. Consequently short stages were quite enough for them, especially as they had to get their food by grazing and browzing

in the little resting time that was allowed them each day. We had relieved them a little by sending the baggage from Awashiri to Tokoro by boat, and they rested on rainy days. As they had rested so one day at Mombets, we hoped to accomplish two stages the next day (18th September), but it began to rain hard before the first stage had been traveled over, and we therefore did not attempt the second, but rested at Sawaki at the end of 18 miles (7.2 ri).

The road was not much diversified. About half-way we passed the very small village of Sharoro, where the hotel was all ready to entertain those of our party who were disposed to rest and lunch there. There were three ferries to cross and the boats and Aino ferrymen were all ready waiting for us and set us quickly across. The road almost everywhere was along the beach, and with a steep, grassy bluff, thirty, forty or fifty feet high, having flat land at the top and dwarf oaks and light woods back, sometimes almost up to the edge of the slope. Near Mombets were one or two hills that seemed seven hundred feet high, a few hundred yards back. Towards Sawaki, a range of high mountains with irregular crest was seen, perhaps ten miles distant.

At Mombets we crossed a headland, and found there a couple of rocky reefs on the two sides of a narrow basin of compact, dark yellowish-brown feldspathic rock with a dip of 20 degrees N. 40 degrees W. on the southeasterly side of the basin, and one of 60 degrees to 70 degrees S. 40 degrees E. on the other side. At Sharoro also we crossed a small headland some fifty feet high, and on coming down to the beach again found some rocks and reefs close by. The rock was the same as before but darker and with small crystalline yellowish-brown grains that seemed to be pyroxene. The dip was about vertical

and the strike of different beds within a few yards of each other varied from N. 40 degrees E. to N. 60 degrees E. With those exceptions we saw no rocks the whole way.

The next morning (19th September), we started off as usual, but by the time I had finished looking at some rocks close by, we perceived that it was going to rain heavily very soon, and as the baggage was not yet fairly under weigh we all turned back. The day was spent in office work, report writing, copying and translating and in mapping.

The rock of the cliffs a couple of hundred yards from the hotel is a very dark gray compact volcanic rock with yellowish-brown and sometimes pale green crystalline grains of what seemed to be pyroxene, and a very few small grains of sanidin. The dip was not clear, but there was what seemed to be a cleavage about vertical with a strike of S. 80 degrees E. In some parts there was a rudely columnar appearance.

Mashike; 10th October.—The 20th of September, although it was Sunday, we took advantage of the fine weather and rode two stages to Chikabutomuushi, 27½ miles, (11 ri), passing the Poronai hotel about half-way.

On leaving Sawaki we crossed within half a mile the head-land, perhaps a hundred feet high, formed by the rock already described, and then rode over a bed of brown sand, with here and there a thin sprinkling of black iron sand below a bluff some twenty feet high, until at the end of half a ri we came to a good-sized brook. At the ford was, below some ten feet of alluvium, an exposure of about ten feet in thickness of dark gray tufa with numerous nut-size pebbles of dark quartzite, and with a dip of some 3 degrees N. 55 degrees E. Then we kept on along the beach of coarse brown sand under a bluff 20 to 25 feet high; and in another ri crossed by a bridge a sluggish, deep-looking stream of some

twenty yards in width in a flat, open, grassy plain half a mile wide and hardly five feet in height above high tide. There we had a fine view of a range of mountains with irregular outline, perhaps five miles (2 ri) distant, apparently of volcanic origin. Half a ri more along the beach under such bluffs as before brought us to a projection in the shore with a ledge and reef of black, shining, feldspathic rock that seems to be pitchstone-pearlite with a strike of N. 70 degrees E. and a dip of 50 degrees northwesterly. A few yards beyond, the strike was N. 50 degrees E. Another half ri brought us to many reefs and an exposure on the beach of grayish-white, hard, compact feldspar with about vertical dip and a strike of S. 65 degrees W. The reefs gave strikes of N. 50 degr es, 40 degrees and 70 degrees E. Still another half ri brought us just after fording the mouth of a deep brook to the banya of Motoenep.

We were told there that last winter a Japanese named Satoö, an officer of the Kaitakushi, with some Ainoes crossed the mountains from Nayoro on the upper Teshio river to Toenep (near Poronai,) in four days, arriving on the 18th of January. They had been on the Teshio river on account of the salmon fishery. The snow was very deep, but the height of the mountain pass was not known to our informant. It is extremely probable that it would be quite feasible to build a road of easy grade all the way from Teshio to Mombets, either by that pass or by one still more nearly in the direct line. The same informant told us that shining, black feldspathic rock like a bit of pitchstone-pearlite we had, was found on the Yūbets and on the Mombets.

Hamamashike; 12th October.—The rest of the way to Poronai, the road was still almost always on the beach under bluffs varying from 10 to 25 feet in height; but crossing three small, rocky head-lands. At those points and

at several others between, rocks were exposed in place, cliffs, ledges and reefs, in all cases old volcanic rocks. At the first place within half a ri trachytic porphyry with sanidin crystals and a little pale pyroxene in a black glassy paste, with no dip clear. A little beyond a very light, gray, hard feldspathic rock (probably trachytic tufa) weathering light brown and buff and honeycombed on the surface; with a dip of 15 degrees N. 45 degrees E. A short distance further the strike of a reef was N. 50 degrees E., and just beyond were reefs of dark gray rock with vertical dip and a strike of S. 80 degrees E.; then reefs and ledges and low cliffs of dark gray, light gray, partly reddish and again dark gray rock without any clear dip; then a wide space without rocks, either side of a deep brook; then another small headland of dark gray rock, with a northerly strike and easterly dip. At the end of half a ri more, a quarter of a mile short of Poronai, was reef of buff volcanic rock, with a strike of N. 50 degrees E. At Poronai, under a bluff some 15 feet high, were low cliffs of light gray feldspathic rock, with a dip of 80 degrees N. 20 degrees W. There was no village there, only the hotel, a ferry and an Aino house. The river seemed to be one of a discharge of a couple of hundred cubic feet in a second.

The road to Chikabutomuushi was still of much the same character, almost always on the beach under a bluff of ten to twenty feet in height, but crossing half a dozen small rocky headlands, one of them as much as fifty feet high, and another by a rather long circuit inland. There were three deep brooks on the way with quicksand and very bad fords. The rocks were exposed at several places and were all volcanic still and apparently trachytic, but, in one case, at least, of especially interesting character.

Five hundred yards from Poronai was a low cliff of a dark-gray, hard, compact, fine-grained feldspathic, pro-

bably trachytic, rock with a dip of 10 degrees S. 65 degrees E. About a ri beyond that, after passing some reefs of gray rock, containing pebbles as large as your fist, we came to another low cliff of dark-gray, compact, probably trachytic rock, with a dip of some 45 degrees N. about 55 degrees W. Within half a ri more we passed a small island of apparently the same a dark gray volcanic rock, quarter of a mile or more from the shore. A little beyond was a low cliff of gray tufa, with pebbles of pea and nut size and with a dip of 30 degrees N. 45 degrees W., and a little further on another low cliff of very dark tufa with pebbles of mustard seed size and with a dip of 40 degrees N. 55 degrees W. In less than half a ri more a small cliff of dark-gray trachytic porphyry with sanidin, with a dip about vertical and a strike of N. 50 degrees E. At the end of another half ri, there was an imperfect exposure of light yellowish-brown tufa with pebbles of nut size and larger. Still another half ri brought us to a small reef of dark-gray volcanic rock, with a dip of perhaps 45 degrees northwesterly. Scarcely a hundred yards beyond, was a small exposure with a strike of N. 50 degrees E. and a dip, north-westerly, of dark gray close grained-rock, perhaps a fine-grained syenite, or a passage to what at length delighted my eyes a few yards beyond.

This was, namely, a very light-gray, coarse-grained syenite, weathering almost white, containing milk white feldspar, glassy quartz crystals, blackish hornblende, and a little blackish mica, all rather coarse grained, a perfect syenite. Its dip was about vertical with a strike of N. 50 degrees E.; a few yards beyond, the dip was 75 degrees N. 30 degrees W. and few score yards further on, it was 45 degrees S. 40 degrees E., forming therefore a basin with dips and strikes conforming well enough to those of the neighboring trachytic rock.' We had met

with pebbles of it in many places on the Toshibets, on the Kunnui, on the Horumui, and on the Ishcari, and Mr. Munroe saw the rock in place on the Toshibets. To-day, at last, we find the rock in place again, and under such circumstances as to show conclusively that it is not, as was conjectured at first, from its character, a very ancient rock, but that it is of the same age as the other old volcanic rocks and, no doubt, like them, of trachytic character. The group of rocks mentioned in my report of last Christmas as the Toshibets-Kuril group, was based on that syenite of the Toshibets, and consequently now becomes an unnecessary name since all these old volcanic rocks are no doubt of the same age as the tufa pebble rocks of Kayanoma, for example, which followed the coal; and are older than the recent volcanic rocks and the Toshibets Karafto group of rocks, which are both mentioned after them in that report. We have here another good illustration of what occurs so often in geological surveys, that the facts observed in one place are to be explained sometimes by observations made in another very distant place, and here on the northwest coast we learn to understand the geology of the Toshibets.

On the Ishcari we found proof that the Horumui-Karafto and the Toshibets-Karafto group of rocks of last winter's report were the same. All the rocks of Yesso, then, older than the alluvium and the recent volcanic rocks, are reduced to four groups: the Toshibets Karafto group; the older volcanic rocks; the Horumui Kuril group; and the upper Ishcari or Kamoikotan group (metamorphic, chiefly dark quartzite, the oldest rocks yet found); and they may therefore be called simply the Toshibets, old volcanic, Horumui and Kamoikotan groups. The main features of the geology of the island are therefore much simplified.

Less than half a ri beyond the syenite was a low cliff

of dark-gray, compact trachytic porphyry, weathering reddish-brown, with a dip of 20 degrees north-westerly. The same rock was exposed all along for some hundred yards with a dip of some 45 degrees north-westerly. Then after the long detour inland, after coming to the shore again similar dark trachytic rocks were seen, and in another ri syenite again in place with uncertain dip, perhaps level. Half a ri more brought us to the hotel aud single Aino house called Chibakutomuushi. The day's journey was so long and trying that the servants and baggage did not arrive until very late, in part after dark.

The woods all day, as far as could be seen, were but light, beginning near the shore, or a few hundred yards back with a stunted growth of small oaks. Besides what has already been mentioned, scarcely a single dwelling-house was passed perhaps not one that was occupied. Since leaving Poronai, we had crossed the boundary between the provinces of Kitami and Teshio.

On the 21st of September, we rode twelve miles and a half (5 ri) to Esashi. The first two-thirds of the way with a ferry in the middle and one at the end over streams of a discharge of perhaps three hundred cubic feet a second, were equally uninhabited and much like the road of the day before, along the beach under low bluffs ten or twenty feet high at the edge of flat land grassy, near the shore, but with light woods further backs, stunted oaks in front. The rocks met with here and there along the shore were interesting as fully confirming the comparative newness of the syenite by its repeated occurrence in alternation with volcanic rocks of apparently trachytic character.

A couple of hundred yards after starting we found some small reefs of the same light-gray syenite, with a dip (apparently not a cleavage) about vertical and a

strike of N. 75 degrees E. Half a ri further on there were small reefs again of syenite that had weathered slightly brown, and with a dip of 60 degrees N. 40 degrees W., also a good cleavage, dipping 45 degrees N. 65 degrees E. A few yards beyond the same syenite formed a reef of blocks running N. 50 degrees E., but nothing to be seen quite in place. A couple of hundred yards skill further on was a reef, some 150 yards long, of fine-grained syenite, with a course of N. 50 degrees E. Thence to the first ferry there were no rocks, nothing but a sandy beach. Half a mile beyond, however, was another reef of brownish weathered syenite, with a course of N. 50 degrees E. A couple of hundred yards further on were great numbers of blocks of dark-gray volcanic rock probably trachytic porphyry ; and a little beyond, a reef of scattered blocks of like looking blocks. But a few yards beyond that, we saw a cliff a dozen feet high and some ten yards long of gray syenite, with a very well-marked dip and curved beds. The dip grew steeper from 30 degrees N. 10 degrees W. to 55 degrees N. 10 degrees W. and 65 degrees N. 40 degrees W. then gentler at the bottom of a basin to 20 degrees N. 80 degrees W. Some 75 yards further on, the syenite is very hard with what seemed to be black feldspar very abundant in it ; the dip there was about vertical, with a strike of N. 40 degrees E. Again 300 yards beyond, on shore and in the water all about, were large blocks of white rock weathered buff with granitic structure, of feldspar, quartz and minute crystals of hornblende, a form of syenite. A large block near by had large (0,05 foot long) crystals of glassy quartz and what seemed to be concretions that, in section, looked like encrinites with a hole in the middle ; in one case a double one ; the feldspar of the block is brownish, giving the rock a buff color. A few yards beyond was a reef of what seemed to be a dark-

gray trachytic porphyry with a course of N. 60 E. but without any clear dip. A few yards more brought us to a small reef of gray syenite, also without any clear dip. Another couple of hundred yards further on was a large reef of fine-grained, compact, dark-gray trachytic porphyry, with a dip about vertical and a strike of N. 45 degrees E. and a cleavage dipping about 25 degrees N. about 15 degrees E. A couple of hundred yards beyond was a small reef of reddish, crystalline rock with a dip about vertical and a strike about N. 60 degrees E. A few yards beyond that was a small cliff of reddish, hard, trachytic porphyry, with a little sanidin and with a dip about vertical and a strike of N. 30 degrees E. Within 200 or 300 yards more was a reef of dark-gray rocks in the water, and close beyond, a small exposure on shore of light-gray syenite, weathering buff, but with neither dip nor strike clear. A couple of hundred yards further on, there was a low cliff of dark-gray, coarsely-granular rock that seemed to be a blackish trachytic porphyry, and that had a dip of 75 degrees N. 50 degrees W., and a cleavage dipping 30 degrees S. 40 degrees W. A. couple of hundred yards beyond that, was a small reef of dark-gray volcanic rock, a quarter of a mile short of the second ferry.

From that ferry to Esashi the road was over a wide, flat, hard beach of brown sand bordered by nearly flat land some fifteen feet high, with light, looking woods back and still further behind that hills of perhaps 800 feet in height. At Esashi two small reefs came to view; the the first of hard trachytic porphyry, with dark-gray paste and some sanidin and many iron rusty-looking blotches that gave a mottled brown and gray appearance to the rock, but without any clear dip. The other reef, a few yards beyond, had a course of S. 50 degrees W.

Esashi turned out to be but a small village of a dozen

Aino houses and a comfortable hotel. The respectful politeness of the place seemed to go beyond anything we had met with, even in the numerous other very polite places we had visited. As the day's journey had been short, we had leisure to do some office work afterwards.

On the 22nd of September we rode from Esashi to Shônai, thirteen miles and three-quarters (5½ ri) with a somewhat more varied route, and too difficult, it was said, to permit of going a second stage the same day. All but the last ri or so, to be sure, was over much the same ground, on a beach alongside of flat land five to twenty and, towards the end, fifty feet high, crossing at times small rocky headlands, but with a range of wooded hills, a couple of hundred feet high at first and perhaps five or six hundred feet high at the further end, running northeasterly and so coming nearer the shore as we advanced until we passed around its end. Then on its northwest side, after passing a valley, we came to another equally high, or higher, parallel mountain with high cliffs along the shore end, so that we had to climb by a very bad road a couple of hundred feet high over its slopes and descend on the northwest side to the hotel and four Aino houses that make up the village of Shōnai.

Within a quarter of a mile of Esashi hotel there were some wide reefs of rock that had been cut down level by the sea. The rock at the nearest point was a dark-gray trachytic porphyry with much sanidin and some hornblende, almost a syenite, with a dip of 45 degrees N. 55 degrees E. There is also a cleavage plane less common and less regular, dipping 70 degrees S. 35 degrees E. A few yards beyond, the strike is seen to curve round, and the dip becomes 80 degrees N. 35 degrees E.; the rock here also is a light-gray syenite, greenish when wet. A couple of hundred yards further on there are reefs with a strike of N. 30 degrees to 50 degrees E. Within an-

other couple of hundred yards is a broad and long reef of rock like the first, with a dip of 70 degrees S. 45 degrees E. Half a ri beyond is another reef of green trachytic porphyry with sanidin crystals and imperfect ones of hornblende and with a dip of 70 degrees N. 60 degrees E., bending round, however, within some thirty yards to N. 80 degrees E., about 80 degrees steep. A quarter of a mile further on there was a cliff of dark-gray trachytic porphyry with sanidin and a very little hornblende and with a dip of 75 degrees S. 45 degrees E. Another quarter of a mile further on was a reef with a dip N. 45 degrees W. about 45 degrees steep; and a little beyond, a reef with the course N. 50 degrees E., made up of pink trachytic prophyry with small hornblende crystals, the rest fine grained. A few yards beyond, the dip was 75 degrees S. 30 degrees E. A quarter of a mile more brought us to a small, rocky headland, apparently of dark gray trachytic prophyry with a strike of N. 50 degrees E. On the other side of the headland the reefs were almost continuous for some hundreds of yards, with strikes, successively, of N. about 45 degrees E., N. about 60 degrees E., N. about 50 degrees E., N. about 40 degrees E. (dip about 45 degrees northwesterly), and and again N. about 45 degrees E. (apparently a buff weathered trachytic porphyry). Then after a gap of a few hundred yards, followed a reef with a strike of N. about 50 degrees E. Then, in a couple of hundred yards more, there was a small headland of dark gray trachytic porphyry, and on the other side a reef with a course of N. about 40 degrees E., rather more than halfway just under the resting house,

A quarter of a mile beyond there was a reef with a dip of 30 degrees northwesterly, and a few yards beyond that one with a very clear dip of 45 degrees S. 40 degrees E., the rock a very dark, coarsely-granular, trachytic porphyry,

with sanidin. Then after a mile, or less of crossing a headland, there was under the first mountain at an Aino village of four or five houses, a reef of rock like the first of the morning, with a very clear dip of 40 degrees S. 40 degrees E.; and close beyond reefs with a strike of about N. 20 degrees E., ending in a low rocky point, apparently of dark-gray, trachytic porphyry. Beyond the point there was for several hundred yards another succession of reefs of apparently the same dark-gray trachytic porphyry, with strikes of N. 40 degrees E. (dip about 80 degrees south-westerly,) N. 50 degrees, 35 degrees, 30 degrees, 35 degrees, 20 degrees, 0 degrees E. (dips all about 90 degrees) N. 30 degrees E. (dip 70 degrees north-westerly), N. 30 degrees E. (dip 45 degrees north-westerly), and a few yards beyond another did about 30 degrees north-westerly. A saddle in the rocks had clearly just been passed, no doubt the same that forms the mountain ridge close by.

Then just across a small headland, we passed a little village of three or four Aino huts and a banya and storehouse, all at that time unoccupied. A couple of hundred yards beyond was a reef of green, compact, probably trachytic rock with calcite seams, and with a dip about vertical and strike of N. 30 degrees E. Then crossing a small rocky headland, we came in a few hundred yards to another reef of the same rock, and a couple of hundred yards beyond to a cliff of it with a dip of 60 degrees N. 75 degrees W. Across another small headland we found first green rock, and then close beyond reddish, compact, probably trachytic, rock, with a dip of 60 degrees N. 35 degrees W. A few hundred yards more brought us to the foot of the second mountain, which we had to climb to some height. The rocks along its foot were reddish, but the dip could not easily be seen. On coming down on the Shōnai side, and only a few

On the 24th of September we rode, still constantly on the sandy beach, from Sarubuts to Chietomai, 13¾ miles (5,5 ri); crossing soon by a ferry the river on the bank of which the Sarubuts hotel stands, a river of a discharge of perhaps two hundred cubic feet in a second. The country was flat but somewhat higher, say twenty-five feet above the sea level at first, gradually rising to fifty, seventy-five and at the end over a hundred feet in height.

The rocks to be seen were very few and all at one bend in the shore. About a ri from Sarubuts there was a small projecting ledge of greenish gray, rather fine-grained trachytic prophyry with sanidin and much greenish hornblende, almost a syenite. The dip was 60 degrees S. 65 degrees E. and a corresponding strike was given by the course of a small reef in the water. There was also a well marked cleavage, with a dip of 65 degrees S. 35 degrees W. About two hundred yards beyond there was a projecting thin rib of similar but more shaly rock, weathered brown, with a strike of N. 40 degrees E., and a dip about vertical. There was a long curved reef opposite in the water.

We had hoped to go to another stage the same day; but it began to rain about an hour before even I had reached Chietomai, and soon rained very hard, and it continued rainy through the day with only intervals of better weather. So we went no further, but occupied ourselves with our usual office work.

On the 25th of September the weather promised better at first, and we rode along the seashore still without climbing any hills from Chietomai to Sôya, at the very northern end of Yesso, 15 miles (6 ri). But the weather disappointed us, and the greater part of the way was travelled in the rain which fell much of the time very violently and continued to do so most of the day, accom-

panied by thunder and lightning. The night had been so clear and cold that we saw in the morning the first hoar frost of the season, so little, however, as apparently to do no serious harm to garden plants.

The land along the shore soon became very hilly as we advanced, rising to the height of perhaps 300 feet with very deep bluffs and even high cliffs along the seaside; but afterwards the bluffs became grassy, rounder and down to a hundred or seventy feet in height.

The rock exposures began hardly a quarter of a mile from Chietomai, with two small ones of gray, small-grained tufa made up of feldspar, quartz, a little hornblende and some minute pebbles of blackish quartzite, and with a dip of 30 degrees S. 35 degrees W. A few score yards beyond there was a ledge of gray, shaly, probably tufaceous sandrock, with a dip of 50 degrees S. 10 degrees E.,' the bed curving in a few yards so as to get a strike of N. 60 degrees E. A few more yards beyond, however, the strike became N. 80 degrees E. again, with a dip of 40 degrees S. 10 degrees E. The exposure was then almost continuous for many score yards, the rock changing to dark-gray shales, but probably still of tufaceous character. The strike became N. 4 degrees W., with a dip of 60 degrees south-westerly. Further on the same shales dipped 25 degrees N. 10 degrees W., a very clear dip. A few more score yards brought us to a dip of 5 degrees S. 60 degrees W.; and again a few score yards more to a strike of N. 40 degrees W. in the same shales. Yet a few score yards more led to an exposure of the former gray tufaceous sandrock, with a dip or (possibly a cleavage), of 60 degrees S. 15 degrees W., but a few yards beyond, a clear dip of about 45 degrees S. 70 degrees E.; and again a few score yards beyond, a dip of 10 degrees N. 50 degrees W. A few yards only beyond there was in a low cliff a very good clear dip of the same gray (rather greenish)

tufaceous sandrock with thin layers of the dark gray shales between, 15 degrees N. 30 degrees W. The dip continued in about the same direction many score yards but steepened to 30 degrees, the strike changing slightly, perhaps to N. 50 degrees E. A few score yards beyond the dip was, perhaps, 40 degrees N. 40 degrees W. Some hundreds of yard further on we saw an exposure of a tufa pebble rock, but with pebbles chiefly of metamorphic rocks, and with a dip of 15 degrees S. 60 degrees W. and a few yards beyond 45 degrees N. about 40 degrees W. a few yards again beyond that, the same pebble rock, with finer pebbles, dipped about 10 degrees and 15 degrees N. 80 degrees W.; and still a little further on some 30 degrees S. 70 degrees W. A few hundred yards more brought us to a cliff of very dark gray, or blueish, volcanic rock, probably trachytic porphyry, compact, with grains of greenish hornblende, and with dips of 20 degrees and 35 degrees N. 80 degrees W. That was just before reaching a village of half a dozen Aino houses and a banya, called 3 ri from Sôya. Just beyond, similar dark-gray volcanic rock dipped first about 45 degrees N. about 50 degrees W., then 20 degrees N. 80 degrees W., then 25 degrees N. 80 degrees W.; and a small island of roughly columnar rock, some 25 feet high close to the shore was passed. Beyond that no rocks were seen until some small exposures within half a mile or so of Soya. It seemed to be a hard, greenish-gray, tufaceous sand rock; with a dip of about 20 degrees northwesterly and further on, about 30 degrees northwesterly.

The land along the shore was mostly open and grassy, but further back there were light looking woods.

The village of Sôya looked much smaller even than that of Nemoro; but has a certain importance as the nearest Yesso port (a slightly sheltered roadstead) to Karafto (Sagalin). The two southern Capes of Karafto

are but a dozen ri (30 miles) distant from Sōya, and are said to be visible in good weather from the hill top though not from the shore. We hunted up a couple of Japanese merchants who had lived sometime in the southern part of Karafto, and they kindly answered our careful inquiries as to the nature of the rocks of that region, which they said were of the same kind as a stone they pointed to in the hotel yard. It was an old volcanic rock, a greenish gray trachytic porphyry, containing sanidin and brownish green amphibole (?) and empty cavities. They also told us that there was a very strong current in the strait between Yesso and Karafto and that it flowed south-easterly at high or rising tide, but south-westerly at ebb tide. The governor of Sôya spoke of the current simply as moving south-easterly towards Mombets, without distinguishing the reflux.

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On the 20th of September we rode from Sôya to Bakkaë nearly nine ri; but I, unlike the others, lengthened the trip to 27½ miles (11 ri) by going round a promontory about six ri from Sôya, in order to see the rocks along the shore. They crossed by a high hill road, but without seeing there any rocks in place.

My road was very level all the way and almost always on a beach. For the first ri and a half there were bluffs and hills alongside, of perhaps seventy-five feet in height almost always open and grassy, and where any trees were to be seen, they were scattered and small. About midway of that distance were small exposures on the beach of a grey rock, apparently an impure lime rock, and nearly in place, but not quite so. Just beyond, however, the same rock appeared to be in place, with a vertical cleavage running N. 25 degrees W.; but the true strike seemed to be N. 40 degrees or 50 degrees E. though very obscure and the dip not clear. At

the end of the ri and a half there was a small river and a ferry, and on the near bank there were greenish shales in place, a small exposure, with a dip of 25 degrees N. 25 degrees W., and on the far bank a small exposure of the same shales and of the tufa pebble rock of the day before with a dip of 10 degrees N. 25 degrees W.

Beyond that the hills quickly disappeared entirely and the whole country was a low, flat plain, some ten feet above the sea, with a wide sandy beach at the edge. At the end of four ri from Soya there was another ferry across a stream "30 ken," 180 feet, wide; and hills of a hundred feet, or more, in height reappeared a quarter of a mile or so from the sea. They grew higher to a couple of hundred feet, and came nearer to the sea, until only a hundred yards or two distant at the neck of the peninsula which the main road crossed. Near that point there began a series of almost continuous exposures of rock that ran around the whole peninsula close to the edge of the narrow, stony beach at the foot of a low bank. The rock was a hard, greenish-gray, fine-grained, probably tufaceous, sandrock, most likely the same as the similar rock we had seen the day before; and perhaps the impure lime rock of the morning was but one variation of it. At the northern end of the peninsula the low plain at the foot of the hills was somewhat wider and reached perhaps 500 yards beyond the end of the hill, a space that is cut off by the road. There is said to be a long reef in continuation of the peninsula; but there is no cliff such as Matsura's map had led me to expect. In spite of the number and length of the exposures the dip was very difficult or impossible to make out satisfactorily, owing to the numerous cleavages and to the wearing of the waves, which made the surface of the rock slope towards the water, and not only the surface but thin fragments that were scaling off. It is most pro-

bable that the strike is about parallel to the general course of the promontory say N. 10 W. and the structure may be that of a saddle.

From the western side of the neck there was a broad, flat beach, with bluffs and hills some seventy feet in height a short distance back, and not a rock exposure all the way to Bakkae. There was in the corner of the hotel yard there a little crag some eight feet high of the gray tufa pebble rock already seen this day and the day before, but with its pebbles of blackish quartzite reduced to the size of mustard seeds. The dip was very clear, 40 degrees S. 80 degrees W.

Bakkae seemed to be made up of the hotel and hardly half a dozen Aino houses; and the long beach we had just traversed was uninhabited. But around the shores of the promontory, especially on the eastern side, were several small villages of Japanese fishermen along with some Ainos. Between that and Sōya, too, there was a very small fishing village at the second ferry, besides a few scattered houses elsewhere.

All along the shore near Bakkae we had for many miles a fine view of the magnificent, symmetrical, nearly conical, high mountain Riishiri, a large island a dozen miles from the shore of Yesso, and also of its lower, more distant, and more nearly flat-topped companion island Rebunshiri ("shiri" in the Aino language means island). By what we could see and by information carefully sought at Bakkae and at Soya we became satisfied that the rocks of Riishiri were all whitish, recent volcanic rocks, probably like those we saw on the upper Ishcari and on the Otopchi; indeed we were told that the Riishiri mountain was still constantly smoking a little, though we saw nothing of it on the Yesso side. On the other hand, the rocks of Rebunshiri appear to be old volcanic rocks, probably tra-

chytic porphyry, of various colors, red, white and gray, "rough and dirty," harder than the rocks of Riishiri.

Very soon after starting the next morning (Sunday, 27th September), from Bakkae for Teshio, 32½ miles (13 ri), I took, by a vertical angle above the horizon, with the pocket sextant, the height of the top of both islands, and found Riishiri to be about 6,000 feet high and Rebunshiri about 1,700 feet high.

Within a quarter of a mile or so of Bakkaë we saw a large crag a couple of hundred yards back from the shore, evidently of the same rock as that of the honjin and with like dip. Near by, also, on the beach we passed some blocks of the same rock and small exposures of it in place with a dip 10 degrees S. 55 degrees W. and with some pebbles as large as an egg. That proved to be the last exposure of volcanic rock that we saw north of Rurumoppe, after seeing no other rocks all the way from Nemoro.

The rest of the ride to Teshio was, but for the beautiful view of Riishiri at our side for one half the way, rather uninteresting and monotonous. Nothing but a wide sand beach, flat and fine and hard at first, but afterwards a little steeper and coarser and looser and difficult for the horse with a low, sandy bluff a dozen feet high, bordering a wide, open, grassy plain with low hills the first half of the way, perhaps 150 feet in height, several hundred yards back, covered with light-looking woods, and with scarcely even a few small streams to cross. Half way we passed a solitary hotel, and here and there the ruins of a former resting house, but otherwise no dwellings. At length with my horse almost thoroughly exhausted we came to the Teshio river near its mouth, and crossed it by a ferry. It proved to be a stream of perhaps four hundred feet in width, and with the breeze we had was quite rough for the shallow flat boat. Then

half a ri or so, partly through low, flat, swampy ground, and partly over slightly higher lightly wooded upland brought us to the little village of Teshio, the capital of the province of the same name, which covers the whole northwestern end of the island.

The village is on the landward bank of a large bayou, a long distance from the river's mouth. The water in front of the village is said to be 20 feet deep, and it is separated from the sea by only a low (say five foot high) sand bar called about two "cho" (240 yards) wide. The water at the mouth of the river is only six or seven feet deep, they say. The place near the village would seem to be a very promising one for building an artificial harbor some time, in a region remarkably destitute of such advantages and at the mouth of a very large valley.

The village consists of the hotel, the government office, three Japanese houses and twenty-three Aino ones. In the fishing season there are forty men to each of the three Japanese dwellings and eighty to the hotel (living for the most part in huts) making 200 men in all. The only product of the place is salmon, of which 1,000 koku (say 10,000 riyos' worth) are taken yearly, mostly from the sea but partly from the river. That would give a return of fifty rios to each of the men employed, not deducting the government tax. Owing to the absence of rocks there is no seaweed, and no nishin (herring?)

We were told at Teshio that Mr. Ishibashi went up the river last year in search of the coal said to be found there; that he did not go above the mouth of the Ambeshinai river, estimated to be 33 ri from the mouth of the Teshio; that he reported finding beds of coal of poor quality (a sample was given us,) and of thickness quite unknown, about three ri below Ambeshinai, and four day's journey from Teshio, at a place which even the Ainos who accom-

panied him now say they do not know; that he found bits of coal further up the river but no bed in place. It seemed decidedly not worth while for us this season to go up the river such a distance on the strength of so imperfect and so far as it went, discouraging a knowledge of the merits and place of the coal.

We gained also some information in regard to the rocks of Teshiri and Yageshiri, small islands off the coast, a little further south, opposite Tomamai. The rocks were described as baked or roasted rocks, and seemed, in fact, to be old volcanic rocks, probably trachytic porphyry, mostly gray and dark-gray, but in some places red, as shown us on rough maps of the islands.

The next morning (28th Sept.) it was rainy, sometimes violently so, with thunder and lightning, and even in the afternoon it continued to be very threatening. We staid, therefore, at Teshio, and went on with our office work, namely, copying the report and mapping the Itashibeoni sulphur place and other mapping and translating.

On the 29th of September we rode from Teshio to Fuurebets 21 miles (8.4 ri). For about two-thirds of the way the road and the country was almost exactly the same as that of the latter part of the day before, a loose sandy beach with low, flat, open ground at the side, and some hundreds of yards back, light-looking woods, and afterwards low hills approaching the shore. One small river had to be crossed by a ferry, and required a little circuit inland. At the ferry were two Aino houses, the only dwellings we saw the whole way.

The last third of the road was quite different. The hills, perhaps 150 feet high, had here come to the sea shore and lined it with cliffs a hundred feet high. The rock was immediately recognized as the soft, greenish-gray sand rock of the Toshibets (Karafto) group, and at the beginning (northern end,) of

the exposure the dip was 50 degrees N. 70 degrees or 80 degrees W. Owing to the height of the waves that day, we had to leave the shore and take the hill road. A horrible road it proved to be, with many steep ascents and descents; and the ground was full of holes and cracks, half concealed sometimes by the weeds, so that the horse stepped into them, once up to his shoulder. The cliff along the shore too, had been thrown into great confusion at some points by breaking off and falling over in large masses. All these unusual appearances were said to have originated with a series of earthquake shocks that took place last spring, beginning the 28th of February, and lasting thirty days, with two or three shocks a day. Just along here was the most violently disturbed region, although the quaking was felt far and wide along the shore. You will see by the date that the earthquake began about three weeks after the eruption of Tarumai Volcano, and was not, therefore, so simultaneous with it as our informant in Sapporo last summer supposed. Probably there was no connection between the two things so far removed from one another (about 125 miles or 50 ri) without any earthquake at intermediate points, and there was probably a mere coincidence in respect of time, and that not a very close one either. Not only had the hill road suffered (which otherwise would have been very bad and seems not to have been in the least repaired for several years, although only a few hours' work would lessen its dangers very much), but the hotel at Fuurebets had been much shaken and a small adjoining building had been tumbled down. There is no village at Fuurebets, only the hotel for the accommodation of the few travellers who pass. It was surrounded on the windward sides by high double barricades of dried weeds, the first case we met with of what we found further south on the west coast to be a common practice for the protection of houses against the cold north-west winds which prevail in winter.

At Fuurebets and on some of the neighboring small streams the hillsides near the shore toward the streams were very clearly terraced at the heights, say of 40, 30, 25 and 15 feet. As the sea has been wearing away the shore, so that former valleys and hills are now cut across by the cliffs and beach, these terraces may have been formerly quite inland and purely river terraces, not sea terraces at all, no indication that the sea stood at these levels. My impression is that the terraces on the different streams did not correspond very closely in height.

The next day (30th September), the waves were such that we could pass along under the cliffs on the way from Fuurebets to Tomamai, 20 miles (8 ri). In some places, however, soon after starting, the small space between the cliff and the water was so encumbered with blocks of stone as to make the passage rather difficult; but after the first half ri or so the beach became wider and the riding easy.

The high cliffs of the same rock were almost continuous the whole way, but numerous small streams were crossed with low, flat ground for a few hundred yards on either side. About half a ri from Fuurebets the dip was 15 degrees N. 40 degrees E., and just beyond that there was immense cross bedding, with dips varying from 10 degrees to 45 degrees N. about 40 degrees E. About a ri from Fuurebets the dip was 20 degrees N. 30 degrees W. Then within a few yards the dip suddenly changed to only about 3 degrees north-easterly, and the rock became light-gray and then greenish clays and then brown gravel.

At 3 ri or so from Fuurebets the rock was again a greenish-gray, soft sand rock, and a large, much worn white fossil pecten 0.4 foot wide was found in one block together with some bits of lignite.

Halfway, we passed near the seashore a solitary hotel at a small stream called Chikubets. A few hundred

yards beyond that the soft, greenish-gray sand rock of the cliffs, with nearly level dip (it had been about 3 degrees south-westerly just before reaching Chikubets,) contained large numbers of very recent looking fossils, of which I gathered quite a number. They were very fragile, white and sometimes possessing still their pearly play of colors. A few hundred yards further on, there were numbers of the same shells apparently that had been washed out by the waves and were stronger. Among them were oyster shells which appeared to have come from the rock since the place was at present unfavorable for their growth.

A ri and a half or so north of Tomamai there was a ferry to cross, and a small Japanese village there and again a few hundred yards before reaching Tomamai some Japanese dwellings were passed ; the beginning of the Japanese population of southern Yesso, and the end of the long space we had traversed where almost the only Japanese houses were the hotels. Henceforth the coast was found to be lined with villages, pretty much as you have seen it still further south, with gaps here and there where a long, sandy beach interrupted the rocks and left no chance for nishin (herring ?) fishing. Tomamai itself, therefore, gave us the impression of quite a large village, with its long street of scattered houses at either end, They said there were, in all, eighty houses, including Aino houses and a dozen in the two islands opposite.

With the pocket sextant I found the height of these islands to be about 550 feet, for Teshiri, and 350 feet for Yageshiri.

The night of our arrival at Tomamai a heavy rain and wind storm set in, and continued on the 1st, 2nd and 3rd of October. We therefore staid at Tomamai, and occupied ourselves with report writing, copying and translating and with mapping. The 4th of October was, at first,

still rainy and doubtful, and as we should probably have to wait a little for the arrival of boats at Herashibets, where we were to go up the river in search of coal and where there was no good stopping place, and as it was Sunday, we staid still another day at Tomamai. The interpreter, however, went on when the weather had cleared, to Rurumoppe where he was to to stay during our river trip, and meanwhile was to hurry up our boats. On looking at Riishiri on the morning of the 4th, it was seen to be beautifully covered with snow for perhaps 2,000 feet down from the top. Also Ofuyudake near Rurumoppe had snow on its top for some distance down.

On the 5th of October we rode from Tomamai to Herashibetsubuto, 22½ miles (9 ri.) The almost continuous succession of house and gardens lasted from the hotel to a ferry, perhaps half a ri distant; a little flat land near the seashore and grassy bluffs and growing lower, from perhaps feet 250 feet to 80 feet high just back of the gardens; and light looking woods still further back.

Near the ferry we saw a temple which seemed to be shared by Booddhists and Shintôists, a "kongo," as it is called, an amicable arrangement that is parallelled in a certain town of Saxony where the Roman Catholics and Protestants worship in the same church, only separated by a grating. The Booddhist temples have been very rare in our circuit of the island, though there was one of moderate size at Tomamai. It seems natural that the gentle faith of Booddha should hardly feel at home among a people whose chief occupation is a kind of wholesale butchery. Shintô temples have been frequent, though often no larger than a bee hive.

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Yedo; 30th October.—The river at the ferry was some thirty yards wide, and was said to be thirty feet

deep; the distance from the sea, either by the river or straight across the low sand bar, was, perhaps, two hundred yards; the depth at the mouth of the river is said to be about four feet. It seemed to be quite a practicable place for a small artificial harbor, if needed at some future time.

After crossing the ferry and a low alluvial plain of half a ri or more in width, bordered by low sand hills (perhaps twenty feet high), towards the sea, we came again to hills along the sea shore; and they continued all the way to the Herashibets with a height of perhaps 150 feet at first and afterwards 100 feet, commonly a few hundred yards back and covered with low vegetation, but here and there coming close to a narrow beach, and exposing the rock in cliffs. Now and then a small valley cutting through the hills showed that the country behind had very light-looking woods. Between the hills and the sea was almost one continuous village of Japanese houses until the boundary of the Rurumoppe district was reached, and from that point onward the beach was wider and there was scarcely a single Japanese house.

At the village of Chashi there was a cliff of soft, green sand rock like that of the Toshibets group but containing small (nut size) lumps and thin seams of lignite in part brightly shining like bituminous coal, but not wholly so, as it seemed. At least one bed, however, of two feet in thickness was a coarse, pea-size, blackish pebble rock, with pebbles of dark quartzite. The dip was 65 degrees N. 50 degrees W. Opposite, in the sea, a few score yards from shore, and parallel to it, are rocky reefs and one sharp, narrow rock, some 25 feet high. The cliffs continue from ten to fifty feet high for some hundreds of yards, and at the next hollow the dip is 40 degrees N. 45 degrees W., the rocks the same, with one rib of egg size pebble rock, holding black, green and

white pebbles. Beyond the hollow the cliffs reappear, and ledges reach across the beach showing strikes of S. 45 degrees W., and dips of 45 degrees northwesterly. The rock is the same green sand rock. Then the cliffs become low (six feet) and thereafter disappear altogether. At the next brook (Charaseushinai) the dip is southeasterly ; and is so also near the boundary of Rurumoppe district. About a mile and a half from the Herashibets low cliffs of green sandrock appear once more in the hill side, and in few hundred yards reach their greatest size in a (75 foot) high cliff that projects into the sea. The dips of several beds are very clear and are 40 degrees N. 50 degrees W. Several beds are exposed as follows, from above downward :

Pebble rock ; pebbles, filbert size of blackish, porous, lava like rock and of white feldspathic rock, ...	perhaps	30 feet.
Pale blue or greenish-gray soft sand rock with pebbles	„	20 „
Soft sand rock and shales weathering brown and yellow	„	20 „
Greenish-gray soft sand rock	„	10 „
Coarse gray pebble rock with numerous *fossils*	„	10 „
Greenish-gray sand rock, weathering brown, with ribs of harder greenish-gray sand rock	„	30 „
		120

The numerous fossils were chiefly casts of shells with a few shells ; one of them, imperfectly exposed, seemed to be a large pecten like the one seen on the 30th of September north of Tomamai in what appeared to be, unmistakably, rocks of the Toshibets group.

A few score yards beyond the high cliff brought us to

ledges of rock with a dip about vertical and a strike of S. 25 degrees W., and a few hundred more to a high cliff again with a rock of large pebbles, weathering brown, with a strike of S. 60 degrees E. and a dip of 25 degrees south-westerly. A few score yards beyond, at the mouth of the Herashibets, was a cliff with a strike of N. 10 degrees E. and a dip of 70 degrees easterly. All the rocks seen during the day were plainly of the same group, and seemed at the time to be of the Toshibets group in spite of the bits of coal and the north-easterly strike; but a careful comparison of the fossils will probably decide the question beyond a doubt.

We crossed the stream by a ferry a few hundred yards above the mouth, and stopped for the night at the small house of the ferryman.

Yedo; 31st October.—Near by on the sea shore I took roughly with the pocket sextant the height of Ofuyudake, about 6,000 feet, and of a high peak between Mount Mashike and the sea, about 4,000 feet. There was much snow on Ofuyudake, but apparently less than on Riishiri, which had seemed to be of the same height. 'Ofuyudake seems to be the mountain marked Shokambetsunobori on Matsura's map.

On the 6th of October Mr. Akiyama and I, with a cook and cooly, and no other servants, and with as little baggage as possible, started up the Herashibets in three small boats manned, alltogether, by seven Japanese and one Aino who was also the guide. We went to look at the coal said to have been worked on that stream seven ri from the mouth in 1866 and 1871.

The first day we succeeded by hard work in going about three-sevenths of the whole distance, say three ri, in a very crooked, but on the whole east-north-easterly, course. The river at first was, perhaps, 150 feet wide, but gradually grew narrower within the first ri to some

60 feet, a width which it retained, with slight variations, all the rest of the way to the coal. The country on either side of the river all day was commonly flat and but a dozen or twenty feet high above the river, but here and there some low hills rose on one side or the other, to a height of 100 feet, 150 feet, even sometimes 200 feet. They and most of the plains were covered with woods that looked in general very thin and light, with here and there some heavy sticks and a great deal of mere brush.

About half a ri above the ferry we found in the bank on our right at the foot of a hill a low cliff of soft, greenish gray sand rock and gray shales, containing many fossil-shells, among others a few oyster shells; also some bits and small seams of shining bituminous coal and a few small ironstone balls, full of casts of shells. The coal streaks seemed not to be of secondary origin, that is seemed to have been deposited as plants at the time the materials of the rock were first laid down. The dip was 60 degrees N. 25 W.

A couple of hundred yards below the mouth of Okennai, a branch stream on our right with a discharge of perhaps 80 cubic feet in a second, there were reefs in the river of greenish-gray sand rock or mustard seed pebble rock with larger (nut size) pebbles here and there. The dip was very clear, 60 degrees S. 80 degrees W., and the strike very straight, N. 10 degrees W. There were no fossils, but the rocks seemed clearly to belong to the same group as those at the last mentioned place.

Towards night fall we pitched our small tents on a pebbly beach, and the boatmen built themselves a lodge with poles and mats,

Yedo, 1st Nov.—The next morning (7 Oct.) we found there was a heavy white frost, and the thermometer as we started at seven o'clock stood at 42 degrees F., never-

theless the boatmen did not seem in the least to mind wading naked in the water whenever the boat ran aground. The river had become pretty shallow and the boats were commonly poled along, instead of rowing, and in many places they had to be pulled by main force over shallow spots or over drift wood. The boatmen were for the most part quite unskilled in river boating, and we had hardly gone half a ri this morning before one of the boats was upset or sunk in a rapid.

In spite of all such obstacles and delays we succeeded in going about three ri before night, in a general east-north-easterly direction, but by a very crooked course. The country was somewhat hillier than the day before, but still there were never hills on both sides at the same time. Their height, too, was not great; some 100 feet, 50 feet, 30 feet, and at the end of the day perhaps 200 feet. The woods in some places were rather heavier on the uplands, but even yet not very large.

A few score yards from the last night's camp we passed, on our right, small ledges of greenish-gray sand rock with, at the lower ones, a dip about vertical and a north and south strike; a few hundred yards further on a strike of N. about 10 degrees W., and a dip of 45 degrees westerly, and just beyond that a small, cliffy point of greenish-gray, coarse, soft sand rock with a very clear dip of 25 degrees S. 70 degrees W. The rock contained well marked, rounded pebbles of coals, as well as thin layers of coal that seemed to have been formed by the laying down of vegetable matter at the same time with the sand of which the rock was formed. The coal pebbles, however, certainly looked as if they had come from a bed of solid, fully formed coal already existing at that time. Half a mile or so further up stream, but owing to a great bend in the river, really but a few hundred yards distant, similar rock was found in place with a dip about level

and close by with a dip of 30 degrees N. 80 degrees E.; and here also were small, rounded bits of coal and some little streaks of coal besides; moreover a few iron stone balls about 0.2 foot thick. About the end of the second mile, and half a mile or so below the mouth of Otoitsukuchi brook, a small branch on our left, there was a ledge of greenish-gray sandrock with a dip of some 50 degrees westerly.

For a long distance after that, no rocks were to be seen but somewhat more than half a ri below the end of the day's journey there was an exposure of greenish-gray soft sandrock and of dark shales, with a clear dip of 70 degrees S. 20 degrees E. There were also two or three irregular, lenticular layers, up to one foot in thickness, of poor looking iron stone. A quarter of a mile or so further up stream there was a ledge of greenish-gray soft sandrock and gray, pea-size pebble rock, with a dip of some 60 degrees southwesterly and a strike of N. 55 degrees or 60 degrees W. A few score yards further up stream the same sandrock and dark shales, in part almost black, formed a long ledge with a dip of 60 degrees southwesterly and a clear strike of N. 55 degrees W., containing several seams of bright coal about 0.02 foot thick, thick, apparently genuine original seams; also a few heavy ironstone balls 0,2 foot thick, or less, and thinly scattered. At the upper end of the ledge the dip was 55 degrees S. 50 degrees W. A few score yards below the point where we camped for the night there was a ledge of greenish-gray, soft sand rock, with streaks of coal a hundredth of a foot thick that seemed quite genuine and not of secondary character, although accompanied by slightly rounded pebbles of coal; the dip was plain, 60 degrees S. 45 degrees W.

The night was clear and cold and in the morning (8th September) we found a very heavy white frost, the

heaviest yet; and the thermometer at the time of starting, about seven o'clock, was at 36 degrees Fahrenheit. Even at that temperature the boatmen did not hesitate to wade in the water; though for my part in my daily bath at the end of the day, the river was so cold as to be almost intolerable.

Within half a mile or so we came to a ledge of greenish-gray sand rock and shales with a dip of 60 degrees S. 30 degrees W.; there were here also some streaks of coal, a hundredth of a foot thick, that seemed genuine original coal seams. A quarter of a mile or so further up stream we came to the lowermost place where coal had been worked. At the river's edge was a ledge of greenish gray sandrock with a dip of 60 degrees S. 25 degrees W. The coal had been dug in the hillside about thirty five feet above and a drift or slope, some ten feet long it is said, had been driven in upon it, but was now fallen in so as to be quite inaccessible. The work was done, they said, in 1866, and abandoned the same year, because only little coal was found. One hearsay story, however, was that the coal was about four feet and a half thick. Some bits of coal, mostly very small, were lying on the ground below the mine, and looked good enough in quality, brightly shining bituminous coal.

A quarter of mile or so further up stream, at a small branch on our right at the foot of a hill some 60 feet high, we left two of the boats and all of the loads and with one light boat went on to the upper coal place through a country still much the same as the day before, but rather hillier; the hills rising to a height of 200 feet and at last perhaps of 400 feet.

A half a mile or so from the boats left behind brought us to a small ledge of greenish gray sand rock with apparently a steep south-easterly dip; and a few hundred yards more to a large ledge of the same rock with a dip

of some 20 degrees S. some 40 degrees W. A couple of hundred yards further up stream there was a low ledge of the same greenish-gray sand rock and of dark shales with a dip of 80 degrees S. 50 degrees E. and with at least one bit of coal, perhaps a single plant. Still a couple of hundred yards more brought us to the lower part of the upper or main coal place of the Herashibets. At the lower end of a long ledge of rock there was a layer of poor limy ironstone, 1,3 feet thick apparently with small fossils; a few feet up stream from that there were two thin lenticular, extremely irregular, crushed seams of of coal, the lower 0,3 foot thick, at most, the upper 0,6 foot, separated by about four feet of greenish-gray sand rock shales. Close about that there are two or three extremely abrupt changes of dip, perhaps from extreme cross bedding. The dips are for example, 65 degrees S. 10 degress E, 70 degrees S. 10 degrees W. and again 70 degrees S. 10 degrees W. At the last point there is the following section downwards:—

Greenish-gray sand rock, mostly soft, with one or two harder ribs exposed some...	20.00
Coal...	1.00
Blackish soft clay	0.40
Black soft shales...	0.20
Coal	0.65
Hidden	1.00
Dark-gray soft shales...	0.70
Black soft shales...	0.05
Light-gray soft shales	2.00
Black soft shales...	2.20
Light-gray shales, with a few lime-stone or ironstone balls, say 0.5 foot thick, irregularly scattered...	3.60
Very dark blackish-gray shales..	1.00
Black shales, crushed...	0.70

Poor crushed (and slaty ?) COAL	0.80
Black soft clay	0.10
COAL	0.40
Hidden	0.10
COAL	1.00
Black soft shale	0.50
Crushed coal	0.20
Hidden	0.60
COAL	0.55
Black soft shale	0.10
COAL	1.15
	39.00

The whole thickness of coal in the lower part of the section, then, is 4.10 feet within a whole thickness of 5.60 feet but these coal seams are all very irregular in thickness and mostly very poor as to quality, and seem to be on the whole very decidedly not workable. The upper or middle part of them was dug into in 1871, and some of the coal was sent to the seashore, but the working was abandoned the same year and a few tons remain on the river bank just over the exposure.

For the next two hundred yards up stream there is an almost continuous ledge of rocks, and near the upper end is the main coal just above a very sharp basin-like fold (synclinal). On the lower (down stream) side of the fold the dip is 45 degrees S. 20 degrees E.; just above, it is about vertical, with a strike of S. 45 degrees E. The coal at this point is seven feet thick, but is plainly much increased in thickness by the peculiar position, just at the sharp fold where also the other rocks are all crushed together in great confusion. The coal bed disappears in the river bed close by the thickest point and in the other direction grows thinner and within a few feet (such is the confused condition of the beds of rocks,) splits into

two portions, forming a letter wye (Y), and the branches, after growing thinner to four feet on one side and 1.8 feet on the other, both come within a few feet more to an abrupt end. On the down stream side of the fold no coal is found short of the coal of the section just given, which, therefore may possibly be the same. But it is still more likely that the main bed is of less extent than that and thins out completely before reaching the point where it should reappear on that side of the fold. It is very clear that such a bed of coal, thick enough and good enough in one spot, to be sure, but of so little extent, is quite unworkable. Some digging was done upon it in 1871, but the labour of stripping off the alluvial earth of the river bank that covered it was too great and the enterprise was given up the same year. A pile of perhaps a hundred tons is still left on the bank close by.

The coal bed had no appearance whatever of having been formed as a secondary deposit from pre-existing coal. It was in long, continuous layers that conformed to the overlying and underlying rocks ; and that had no appearance as if made up of pebbles of coal.

The main coal if seven ri by the windings of the river from the sea, was in a straight line just about three ri from the mouth of the river in a direction nearly due East. Its height above the sea was perhaps not more than a hundred feet ; but the aneroid, owing to change in the weather, was not very exact.

It was useless to spend more time in searching for workable Coal in so very unpromising a place, and as soon as we had lunched we set out on our return down stream. Our progress was much more rapid than in going up, and we camped at night near the place where we had lunched the day before, about three ri below the main coal.

Just before camping we saw a large black bear scramble up the steep river bank some fifty yards before us. At the top it stopped and looked at us boldly, or else at the dog that was coming after it across the river, but our Aino, a renowned bear hunter, beat the side of the boat with his oar, and the bear took flight. The dog was recalled by a low whistle. It seems rather curious that even in Japan where so very many customs have originated quite independently of western countries, the whistle is appropriated to the dog and the cluck to the horse, just as in the rest of the world.

It was interesting to see how naturally the Aino took command of the young Japanese boatmen, who were mostly quite inexperienced in river boating. Never indeed in Yesso have I been able to see the least jealousy or hatred between the Ainos and Japanese.

The next morning (9th October) we kept on our way down stream and reached the ferry (4 ri) by the mouth again very soon after noon. On our way we had leisure to admire the beautiful colors of the autumn leaves just about in their prime and very brilliant. The first changing of color had begun to be slightly noticeable as far back as Mombets, the 16th of September.

Our horses were waiting for us at the ferry and we set out at once for Rurumoppe, five miles (2 ri) distant After leaving the half-mile wide flat near the ferry, the road lay along the seashore with rounded hills of perhaps 100 feet in height and afterwards rather less until a few hundred yards short of the town a low flat was reached. About half-way, there was a village of many houses.

Near the beginning of the hills there was a small cliff of greenish-gray sand rock with a dip of some 70 degrees S. some 10 degrees W. Likewise, near the end of the hills

there was some greenish-gray sand rock exposed in the hillside with a dip of perhaps 10 degrees north-easterly.

Yedo ; 2nd November—The same evening at dusk we went to look at the drawing of the salmon net on the beach opposite the hotel. The number of fish caught happened to be small, only a couple of hundred ; it was not one of the lucky times when 6,000 fish, or a hundred koku, are taken at once. The net had been formed into a sack and was just coming to land at our arrival on the beach. It was hauled along with difficulty by a few men on the shore and a dozen young men stripped to their waist cloth in the water. A large number of the townspeople, young and old stood looking on, and among them half a dozen or more of Aino women. A shallow bin had been formed close to the water's edge by coarse mats spread on the ground and planks set on edge parallel to the shore line. As soon as the net had been brought to the side of the bin, the men began taking out the huge fishes in their hands and throwing them into it. At the same time a number of flaring torches of bundles of bamboo dried with the leaves on, were held aloft by young men, lighting up a very animated scene. The fishes were seized by the Aino women, opened and gutted (without cutting off the head), and thrown down on the mats above the bin ; were then loaded by the hands of young men or by the hooked staff carried by-well-to do more elderly men into creels upon the backs of women and so carried to the door of a store-house a few yards distant ; were there thrown on the mats of another shallow bin, and were thrown from that into the house by the hands of two young men who counted them at the same time with a loud chant ; finally in the house the salmon were rubbed and sprinkled liberally inside with coarse brown salt and piled up criss-cross in a great stack with a layer of the same salt an inch or two thick

between every two layers of fish. The building would hold some 1,500 koku of fish; and was to be emptied from time to time as junks sailed for Yedo with the salmon and salt in the same condition as we saw them. The whole business was transacted so promptly that at the beginning it was scarcely three minutes from the time when a fish was struggling in the sea until he had taken his place in the pile in the house. The spectacle was not uninteresting, but was no less digusting than most of the steps by which animals in general are converted into human food. The women, however, who played the part of butchers seemed to be impressed with no resemblance to themselves in their cousins the fishes, no more than in their doubly distant cousins the vegetables. As for cleanliness the fishes had not a single dip into water either during or after the operations upon them.

Among the salmon were a few with a hooked nose such as the river fishes have, and they were set apart for home consumption; as in like manner were a few fishes of other kinds. Among the rest was a large sunfish, as it seemed to me, prized for its oil.

As we inspected the work some of the more important overseers recognizing my excellent companion Mr. Akiyama came and greeted him with respectful and pleased faces; for he was governor of the district of Rurumoppe only a few years ago. We, his companions, of course did not fail to joke him on his fallen grandeur, but without succeeding in disconcerting his constant good humor. I did not after all discover the cause for which he had been removed from his office. It is not to be supposed to be sure that a wise and fatherly Government would discourage good behavior by such a reward; still even the wisest sometimes through misinformation or otherwise may make a mistake, and I hardly believe that the district can possibly have found

since his time a more gentlemanly, honorable and efficient governor.

The village of Rurumoppe itself was not very large though the district was very populous compared with what we had seen further north.

In consequence of rain in the night and threatening appearances the next morning (10 Oct.) we started rather late, but rode, in spite of a little rain on the way, 10¼ miles (4.1 ri) to Mashike (at the place marked Pontomari on Matsura's map,) the furthest point we could reach that day at any rate, on account of the long, difficult stage beyond. As they were just building a new bridge at Rurumoppe we had to cross the river in small boats. Immediately thereafter we crossed a small headland, perhaps half a mile across and fifty feet high.

Yedo; 3rd November.—On coming down to the sea again we found towards the end of the head exposures of rock in cliffs, ledges, reefs and islands. The ledge near the end of the point was a very dark-gray, very hard, compact, fine-grained, trachytic porphyry with very small crystals of sanidin (or at least transparent feldspar) and small yellowish-brown and green grains (of pyroxene?). The rock weathers with small holes on the surface; is somewhat columnar; and the dip is 50 degrees N. 30 degrees W. On the small islands opposite, of some ten feet in height, the rock is even blackish and very columnar. A score of yards or more south-easterly, the rock is the same; but columnar and with a very obscure dip; and is much besprinkled with a white radiated mineral that looked like aragonite, mostly in very small specks.

A ri or so of sandy beach bordered by bluffs of perhaps 50 feet in height, which were covered with grass and bamboo and had a nearly level top, brought us to some cliffs perhaps 30 feet high of soft greenish gray sand

rock with a dip of some 3 degrees N. 30 degrees E. or else about level. A few yards further on, the dip was perhaps 3 degrees N. possibly 50 degrees W.; and still a few yards beyond, it was 10 degrees N. about 80 degrees W.

The rest of the way to Mashike the road was along the shore with bluffs and hills of irregular shape, perhaps 100 to 150 feet in height, from a few yards to a couple of hundred yards distant, generally grassy but with a few trees to be seen far back. There were houses almost all along wherever there was space for them.

Here and there a small exposure of rock was to be seen, always greenish-gray soft sand rock, apparently of the Toshibets group and generally with a nearly level dip. A few hundred yards beyond the last mentioned cliffs the dip was some 5 degrees north-easterly (?); a few hundred yards further on 10 degrees S. some 60 degrees W.; a few score yards beyond that the same rock, but no dip was clear; a few hundred yards again, the same rock without any clear dip; a few score yards further, great sloping cliffs, perhaps 150 feet high, of the same rock with a dip about level. A few hundred yards further on we crossed by a bridge the Nubusha, a river of a discharge of perhaps a hundred cubic feet in a second. It is said that Matsura crossed by this river and by the Uriu river in four days to the Ischari river (or from the Ishcari to the sea); and that some bits of coal have been found near the head of the Nubusha but no bed of coal. A few hundred yards before reaching Mashike we passed under a cliff of greenish-gray soft sand rock perhaps 90 feet high with a dip of some 10 degrees north-easterly.

In the afternoon we were occupied with office work as usual.

Mashike seemed to be a village of some importance. It

was remarkable in our travels as the first place we had seen where there was a school, since we left Sapporo. The total lack of schools on the whole coast from Birô all the way round by Nemoro, Sôya, Teshio and Rurumoppe to Mashike seems to do hardly justice to the unusual love of learning that distinguishes the Japanese nor to the generosity of the government; but it must be borne in mind, as some palliation of the seeming neglect, that the Japanese population through the greater part of that distance is very thinly scattered, and especially that most of it is made up of mere summer visitants, laboring men without their families (perhaps partly owing to the lack of schools). Nevertheless the Aino population at some points, and even the Japanese, is quite enough to make at least primary schools very desirable. Schooling of course is one of the most important steps to be taken in the elevation and enlightenment of the Ainos; and the existence of good free schools would be one of the greatest attractions to Japanese immigrants. At the same time primary schools, the most essential of all, would cost so little, that they would plainly be among the most useful things for which the money intended for the opening up and settlement of the island could possibly be laid out. The improvement it would also work in the intelligence and character of the inhabitants would undoubtedly be very great, and lead to their increased skill in turning to account the various natural advantages of the new country which they inhabit.

Yedo; 5th November.—Mashike was very notable too for its hotel, perhaps the finest we had met with anywhere in Yesso; also for the curiosity of the inhabitants in regard to foreigners, a feeling that was probably the greater in consequence of the somewhat better education and intelligence of the place.

On the 11th of October in spite of threatening weather

we hastened on so as to cross the famous Mashike mountain before the road should be blocked up by snow. A bitterly cold strong wind not only made us very uncomfortable but by the high waves it raised quite prevented us from going round the mountain by sea. We rode however to Hamamashike, 24 miles (9.6 ri).

The ascent did not begin until we had gone a ri or more along the same populous seashore with low hills on our left most of the way. We then went up a long ridge and rose pretty steadily to a height of some 2,300 feet above the sea; then still following the ridge had to descend and again climb two or three times heights of a couple of hundred feet, reaching at length to 2500 feet above the sea on the flank of a peak to our right that rose perhaps 500 feet higher. Then after another descent of a couple of hundred feet or more we rose again with occasional small descents until we had reached a height of about 3,800 feet above the sea, the highest point on the whole road.

Near that we found a couple of small exposures of rock in place without any clear dip. It seemed to be the same rock as had been exposed in loose blocks all along on the mountain, trachytic porphyry with a very dark gray, blackish paste and with numerous sanidin crystals and some brownish, crystalline grains, apparently partially decomposed greenish, not very black, hornblende, or possibly pyroxene. Those were the only exposures in place seen on the mountain except some not very large cliffs high up on the peak just mentioned.

From the highest summit we had to descend 700 feet to the crest of a dividing ridge only to remount to a height of 3, 700 feet above the sea, the very top of a peak opposite the real pass several hundred feet below, between us and the snowy Mt. Mashike on our left. There was a trace of snow even on the summit we passed, and

the thermometer was at 38 degrees F. a little before two o'clock in the afternoon, and a few snow flakes were falling. It was not at all too early in the season to get through with the crossing of the mountain.

The road henceforth descended very steadily and at first very steeply for a long distance, and then with the interruption of only a small ascent continued downwards even to the sea shore. Then by a very stony path, with blocks of old gray volcanic rock (probably trachytic porphyry) under bluffs of perhaps 60 feet in height, and afterwards of a hundred, passing two or three small valleys where there were hamlets or villages, at last the little village and hotel of Hamamashike were reached. As I had started about seven and had not stopped on the way for food or rest, I arrived soon after five o'clock ; but the others, especially the baggage, did not came in until long after dark. Indeed this stage and the next (which they said would be still worse) are proverbial in the country for their badness. The road we had just gone over would be no disgrace to a community of goats or to the deer who probably laid it out for the most part, but to men with hands to throw away the loose stones and even without picks, shovels or the knowledge how to blast rocks, it would be far from creditable. After passing the highest point it was in many places almost impassable for horses even without loads ; and the baggage had to be unloaded at times. No repairs on that side would appear to have been made within the past ten years at least, if ever. But the road is so barbarously laid out as to require thousands of feet of needless climbing ; for it follows the crests of hills up and down and high above the real pass instead of winding along the hill sides until the pass is just crossed by a uniform easy grade. Of course in the earliest antiquity (when the road would seem to have been first adopted by men), without shovels a road could not have

been dug along the hillside and without powder a rock here and there could not have been removed by blasting. It is even possible that a well-engineered road might be carried round the seashore at a much lower level, above the cliffs there or perhaps even below them.

Above, say 3,000 feet in height, there were no woods except sometimes low brush and the five-leaved pine; the rest of the way on the mountain there were light woods.

The next day (12th October) was stormy at times all day, and we did not travel; but continued our office work, report-writing, translating and mapping.

On the 13th of October, however, after repacking some of our luggage for the greater convenience of the men who must carry it the whole distance because part of the road was too bad for horses, we set out on foot for Atsuta called 21¼ miles (8½ ri) distant. Perhaps, however, a scarcity of pack horses helped to make the master of the posting house insist that the baggage must be carried by men; for it turned out quite possible for it to be carried by horses at least the first half of the way and also the last third. The space that was quite impassable for loaded horses was in fact very short, and the more vexatious as a few hour's work of even the men that carried our baggage would have made the road more passable than the one across the Mashike pass. But in these parts men commonly travel by sea, and the roads are wholly neglected. Unfortunately for us the waves were too high to go round by water.

On leaving the hotel we passed by a very stormy road along the seashore under a bluff perhaps 75 feet high with high cliffs of very dark-gray, trachytic porphyry, in the form of a very coarse, tufa pudding-rock with blocks three feet through or more. A few steps further on there was in a rock a pebble of

white, trachytic porphyry with paste of pumice, or almost pumice, and with sanidin and a little hornblende.

A few hundred yards beyond that there was a village at the mouth of a river some thirty yards wide which we crossed by a ferry. Then half a mile or more along a low narrow sand bar brought us to the foot of bluffs again which rose above into a hill of 300 feet or more in height. But another half mile led to a small valley in which there was a little village and beyond which the hills came so close to the shore as by the cliffs to cut off progress there in the rough weather we had. So we had to climb the hill some hundreds of feet high. The cliffs were of dark-gray, trachytic porphyry, with much sanidin in small grains and many yellowish-brown grains of what seemed to be partially decomposed hornblende. The dip seemed to be about 80 degrees south.

On the hill road after passing a host of our baggage carriers I overtook my horse and had a short ride, the only relief of that kind until night fall. For on coming to the descent from the hill, though it was not impossible for the horse, it was so difficult and he was so slow that he was left far behind. The road wound about among the hills for some distance, but finally, within two or three miles, came down to the sea shore again at the mouth of a small valley with half-a-dozen houses.

Thence a foot path impassable for horses saved climbing the hill and passed under cliffs along a very stony shore. The rock was dark-gray trachytic porphyry with much sanidin and with hornblende and at one place for some distance a great deal of bright red or rosy glassy feldspar, as it seemed. The dip at one spot seemed to be perhaps 25 degrees N. 30 degrees E. A rocky point a few yards beyond gave the dip more clearly 50 degrees N. 30 degrees W. After passing a small hollow the

rocks were a very coarse (about two foot) tufa pudding-rock of dark gray trachytic porphyry with much sanidin.

Soon a larger hollow was reached with four or five houses, and from there it was necessary to climb over a hill to a height of perhaps 500 feet and descend in a smart shower to the hamlet and hotel of Gokibiru, about half-way from Hamamashike to Atsuta, it was said; and there we stopped to lunch and rest a little.

After as speedy a meal as vigorous expostulations could obtain we set out again soon after two o'clock to to cross the redoubtable Gokibiru pass, coupled in proverb with the Mashike Mountain road. Incorrect information at the hotel made out that I could ride no part of the way across the mountain, and so the horse had been led on before. The road quickly left the sea shore and climbed up at first gently, afterwards steeply, until the crest of a dividing ridge was reached. Then we passed along the crest going over summits of about 1,300, 1,500, 1,650 and 1,700 feet above the sea with hollows between, a few score feet lower. The ridge formed a large amphitheatre on our right opening on one side towards the sea, and on the other side joined to a dividing ridge which it was the main object of the road to cross and which formed with the amphitheatre a letter wye (Y), as you may say. At the crutch of the wye, two very fatiguing hours' walk from Gokibiru, we reached the highest point, not far below the top of a peak on our right and some distance above the real pass on our left. Thence we descended rapidly by a narrow valley containing here and there exposures of tufa pebble rock with pebbles of fist size and double that of dark-gray trachytic porphyry. The woods here as everywhere else through the day were only light. In that valley also were a few places in the road so completely out of repair that a horse could scarcely be led over them, yet capable of being easily made passable.

At length we left the valley and climbed over a nose of the hill to our left, and, after winding along the hillside for some distance, crossed a stream and kept down its left side until we came to a broad, comparatively gentle slope. Soon thereafter a steep zig-zag brought us to the seashore and a village, just after dark and four hours from Gokibiru.

The horse was waiting for me and, although I advised to no purpose that the others without horses should wait until morning before going on, I mounted to ride the remaining couple of ri, as it was called, to Atsuta, having no idea of the real nature of the road, supposing it to be along a beach, and even starting without a lantern. Beach indeed! The shore was covered with huge stones that made it almost impossible for a horse to go along; here and there a jetty built by the fishermen obliged us to go deep into the sea waves; often the road was so obscure as scarcely to be made out even with the lantern that we soon had to borrow from one of the houses that were scattered all the way. So we blundered along at a snail's pace, until about half-past eight we reached a village with a better road and crossed a river by a foot bridge some hundreds of yards above its mouth. Then we returned to the seashore and with a somewhat easier, in part sandy, road under high cliffs crept along until at ten o'clock we reached the hotel at Atsuta worn out with fatigue and exhausted with hunger. It was about midnight before we finally got to bed.

The next morning (14th October) on rising as usual at half-past five I was surprised to find that my faithful "boy" and the coolies who made the Ishcari trip with us had just arrived after having travelled through the night. They had come it seems in company with about a dozen of the baggage coolies who were late in crossing the mountain. Other coolies lay down for the night before getting to the seashore.

Yedo; 6th November.—The weather in the morning was rainy at first and we did not set out for Ishcari, about 11¼ miles (4 ½ ri), until afternoon, and even then it proved rainy. Meanwhile an amusing occurrence took place, a full account of which, if necessary, I reserve for a separate communication. It resulted in the interpreter's absenting himself from our party for a couple of days, and in the discontinuance of his translation, which I can therefore only give you in an imperfect state.

Almost immediately on leaving the hotel after crossing a rivulet we rode along the beach under cliffs again, first of perhaps 200 feet, then 50 feet and afterwards 75 feet in height made up of soft greenish-gray almost shaly sand rock with one or two hard bands like iron-stone about a foot thick. The dip near the beginning was 20 degrees S. 30 W. The rocks were evidently of the Toshibets group, and the same cliffs of it reached northward as far as the river we crossed about half-past eight the night before. Beyond that northward the rocks were no doubt the same old volcanic rocks we had seen on the mountain, probably dark-gray, trachytic porphyry.

For several hundred yards along the beach, about a ri or less after leaving Atsuta, we saw a number of pebbles that have attracted the attention of the neighborhood as ornamental stones. They are chalcedony that has been rounded and slightly polished by the surf. Most of these are white and translucent, but some are tinged of the color of iron rust by iron and are somewhat more opaque. They have not been found anywhere in the cliffs along side and have been supposed to be "thrown up by the sea." Of course they are not formed out of sea water, and there is no special probability (though there is a possibility) that any bed of rock different from what is seen on the shore crops out under water and furnishes the pebbles. It is most likely that they come if not from the

greenish-gray sand rock, then from the alluvium which caps the cliff. They are not very numerous nor of much value, as the stone is not a rare one, but would if cut and polished make pretty buttons or seals; they are too small for paper weights.

At a point in the cliffs about a ri and a-half from Atsuta in the cracks of the rock about five feet above the sea with a dip of 10 degrees N. 40 degrees E., we saw some traces of rock oil, that have attracted much attention from passers by. There is however in all scarcely a spoonful of oil and it has no value or importance whatever except that it shows well the true source of the oil of Washinoki and the other places, which was at some points not altogether clear last year. The oil undoubtedly comes in all cases originally from the rocks of the Toshibets group, though sometimes it has entered the overlying alluvium and collected there. The certainty we now have on that point is an important guide, if the working of those small oil deposits is to be carried on.

A few hundred yards beyond the oil traces the cliffs came to an end and were followed by steep grassy bluffs of about the same height which likewise came to an end in several hundred yards more. There were light-looking woods some hundreds of yards back. Thenceforth as we rode along the broad, sandy beach all the way to Ishcari, we had on our left a wide open grassy plain hardly ten feet high above the sea, the lower end of the great alluvial plain of the Ishcari river. We passed two or three small fishing villages of some half a dozen houses each. Salmon is caught on such a sandy shore, but there are no nishin (herring ?) nor seaweed.

On arriving at Ishcari, right bank, I looked once more at the warehouses and piers and dock built there two or three years ago. They had the appearance of being still

but little used if at all, and the dock is silted up so that there is bare ground at one corner. Of course the comparatively still water produced by the piers in such a place is highly favorable to silting up.

On crossing the ferry to the main village on the left bank we were pleased to find a decided improvement since last year. The number of new buildings, some of them quite large, showed plainly that the place was very prosperous.

The next day (15th October) after repacking some baggage and writing some business letters we rode along the coast from Ishcari to Otarunai, 23 miles (9.2 ri). The first two-thirds of the way, as far as Zenibako, was over low, nearly flat land with wind-blown, grassy sand ridges near the sea beach and with still lower, perhaps wet, land behind, and with stunted trees some hundreds of yards from the shore. From Zenibako to Otarunai the road lay almost all the way on the narrow space between the sea and bluffs of 60 to 200 feet high often high cliffs. About the beginning of the cliffs, a ri or so from Zenibako, the rock is a brecciated, dark-gray, trachytic porphyry with sanidin. Nearly opposite is a small rocky island with tufa pebble rock at bottom and very large pebbles or breccia at top and with a dip of 30 degrees N. about 50 degrees W. A few yards further on, the road passes through a small tunnel cut in the coarse tufa pebble rock of dark-gray trachytic porphyry with a great deal of sanidin ; and, just beyond, there are very high cliffs and a pulpit rock apparently all of the same material. Bluffs, perhaps 125 feet high, very steep but grassy with here and there high cliffs of coarse tufa pudding rock of light-gray trachytic porphyry continued for a ri or so more, and then culminated (just half-way from Zenibako to Otarunai) in a height of perhaps 250 feet with very high and long cliffs of columnar volcanic rock, light-gray and

partly dark-gray trachytic porphyry with much sanidin and hornblende, and in the dark rock other dark yellowish-brown small crystalline grains, perhaps amphibole or possibly pyroxene. The dip as observed last year in June seemed to be gentle N. perhaps 60 degrees W., the reverse of what was noted about 200 yards towards Zenibako. The columns are about vertical and very irregular in cross section and lengthwise. Below those high cliffs there is an enormous talus of large blocks all the way to the sea and the road has to pass over them. From that place to Otarunai there are few or no good exposures of rock near the road; but bluffs continue with little interruption all the way, and are from 200 feet down to 60 feet in height. Just before reaching Otarunai the road passes over a hill of perhaps a hundred feet in height, and soon after reaching flat ground again and the outskirts of the town it passes a small isolated white rock a dozen feet high of pumice or what is nearly pumice but rather more compact.

Climbing over the hill just mentioned was lately avoided by a road built along the sea shore and a tunnel or two near the end of a rocky point; but the late heavy storm at the beginning of October, had torn the road to pieces so as to make it impassable. In many places, too, not far from Zenibako, the same storm had destroyed the road and made it almost impossible for horses to get along. Seven junks had at the same time been wrecked at Otarunai and some damage done to the houses of the town along the shore but already none of the mischief was noticeable to a passer-by except the wreck of a large junk at the water's edge.

Yedo; 7th Nov.—The next morning (16 Oct.) after finishing a letter to you and some other office work, I set out from the hotel; but soon left the sea shore and went in a boat to call on the captain of the steamer *Capron*, which happened to be in port, and to send you by him

the first 96 pages of this report along with their translation. Then on reaching shore again I rode to Rubeshibe by way of Yoichi, 30½ miles (12.2 ri) from Otarunai.

The road for a ri or so passes near the sea shore through the village of Otarunai and the adjoining Temiya and has commonly a bluff upon the left. Between the two villages the space for houses is narrow and little occupied, and there are some exposures of rock in small cliffs and little rocky islands just inside the water. The rock is light-gray, trachytic porphyry apparently, with sanidin and in places weathered on the surface into little pits. The dip at the first exposure met with was taken last year in June, 60 degrees S. 60 degrees W.; a hundred yards or so farther on, it was about 50 degrees S. 35 degrees W.; about 20 yards still further on, it was 35 degrees S. 45 degrees W., and about 20 yards beyond that and 100 yards short of the bounding brook between the villages the dip was 65 degrees N. 55 degrees E.

Yedo; 8th November.—The road after turning to the left from the seashore rose by a shallow valley to the top of a dividing ridge at a low point and then skirting the hill side to the right soon crossed the hollow to the left near its head, and passed over another dividing ridge and down into a deep narrow valley where there was a house by the road side. Then sideling up the opposite hill to the left another low pass in a dividing ridge was crossed; and the valley was entered by which with a long gentle descent a village on the sea shore was at length reached. The hills are gently rounded; and at one point a long gentle slop seaward is to be seen, apparently the comparatively rapidly descending slope of old alluvium of the bluff deposit mentioned in my report of last winter, not exactly a level terrace such as is found sometimes on the shore of the sea or of lakes or even of rivers.

After passing through the village and crossing a couple of small streams in it, the road went over a steep hill and quickly came down again to another village by the sea. Along the shore at the end of the hill, some 400 yards short of the village, are pale, greenish-gray cliffs perhaps 150 feet high close under the road on the sea shore. At the top, as noticed last year, is light-gray thin layered, probably tufaceous sand rock perhaps 25 feet thick ; below that, greenish-gray thin-layered probably tufaceous sand rock perhaps 20 feet ; then under that dark-brown, below almost black, no doubt tufaceous, very coarse pebble rock ; from that to the bottom of the cliff, light-gray, undoubtedly tufaceous, thin layered coarse pebble rock. The dip is about 30 degrees N. about 45 degrees W. Crossing a narrow valley we rose again to a hill top and winding round the head of two short seaward hollows descended again towards the village of Oshoro with its little harbor in sight, four ri from Otarunai and two ri from Yoichi. But instead of going to the village I turned off by a valley to the left which brought me by a single gentle descent to the next village on a sandy sea beach. Packhorses have to go to the post station at Oshoro, and thereby not only is the distance increased, but a couple of hills have to be crossed. Though not mounted on a post horse, I was taken twice through the village last year before I discovered the shorter road. The rocks at Oshoro as observed last year in June are greenish-gray, coarse pebble rocks, weathering slightly brown. The little harbour is a very pretty cave between a small narrow promontory on the east and a high hill on the west, the hill that has to be crossed on setting out for Yoichi.

On entering the village on the beach next to Oshoro, as already mentioned, a high cliff of greenish gray, probably tufaceous rock is seen to the right at the end of the

hill just spoken of. After traversing the village and a short sandy plain the road crosses a steep narrow hill with an artificial cut of some twenty feet in depth at the top, and comes down again at once nearly to the sea level alongside of cliffs of greenish-brown and greenish-gray very coarse, tufaceous pebble rock, with many large black pebbles and with a dip (June, 1873), of about 40 degrees S. about 35 degrees E. We had then but to ride over a low sandy grass covered plain close by the beach for about a ri to the ferry near the mouth of the Yoichi river.

A few hundred yards above the ferry but hidden from the road by low grassy sand hills are the two interesting farming villages of Kawahigashi and Kawanishi which we visited last year. They are in a fine alluvial plain that reaches back in a triangular shape a couple of miles from the sea, and contains therefore some 1600 acres. It is all unwooded like almost all the land we have seen between it and Otarunai; but is covered with high weeds and bamboo.

After crossing the ferry and turning to the right it was but a quarter of a mile round a high, rocky hill to the Yoichi hotel in a little hollow along with the small hospital, cut off from the main village just beyond by a narrow low cliffy point of volcanic rock. Last year in May and in June we found some obsidian in coarse pebble rock at the end of the point, and some of the obsidian had in it rows of imperfect probably feldspathic crystals. Some small portions of the rock looked like pearlite with pebbles smaller than peas. The dip was 75 degrees south-easterly with a strike apparently of S. 85 degrees W. Most of the rock would seem to be a gray trachytic porphyry.

We had planned staying at Yoichi over night owing to delays in the starting of the baggage in the morning;

but as I had learned on board the "Capron" steamer that the mail steamer was daily expected at Hakodate, I determined to push forward as rapidly as possible in hopes of catching it. Leaving word therefore that the rest should stay at Yoichi over night and overtake me next day at Iwanai, where they would have to wait at any rate until I could visit the Kayanoma mines, I lunched as quickly as possible and set out after two o'clock for Rubeshibe, six ri distant.

The road after passing for a half ri or so through the village left the seashore and going up a rather narrow valley with a large brook, at the end of another ri turned to the left again and climbed a hill, passing over two or three summits and finally the highest one about 350 feet high above the valley and perhaps 500 feet high above the sea, at two ri from Yoichi. Then descending a ravine we came in a few hundred yards near to the Yoichi river, and at a little distance from it kept along the foot of a steep hill side on our right. Near the beginning of the hill side there was exposed some shaly rock, perhaps tufaceous, of a pale greenish-gray color. Some hundreds of yards further on there were high narrow cliffs of gray, volcanic porphyry, apparently trachytic. A few hundred yards beyond that we crossed a pretty wide and long valley with a large brook, the Shikaribets, and passed a couple of houses perhaps both hotels, about 100 feet above the sea. Then we climbed to some height on a steep hillside close to the Yoichi River, and after descending and leaving it for a while came near to it again and by a very bad road passed over several hills until we finally left the river and bore off to the right, and gradually rising over rolling ground at last reached the solitary Rubeshibe hotel about half-past six, some time after dark; at a level of about 300 feet above the sea. Here and there were more or less imper-

fect exposures of volcanic rock, apparently still trachytic porphyry ; but about half a ri short of the hotel there were some gray clayey shales in which we found some fossils last year in May. Soon after passing that point I was overtaken by my Japanese travelling companions who in spite of the directions left at Yoichi had ridden forward rapidly. The servants and baggage also toiled along, even after dark, until the horses on so bad a road refused to go further, and they stopped for the night a ri or two short of Rubeshibe.

The hotel keeper at Rubeshibe told me with a very intelligent and lively interest that a new road was to be opened in four or five days by which the distance from Yoichi would be only three ri, and "all level, not a single "hill;" and he showed a rough map with both roads on it. The new one goes up the right bank of the Yoichi river instead of the left and near the upper end crosses by a ferry. Near the lower end the road passes through the two farming villages already spoken of, and keeping back from the seashore reaches the cliffs at the eastern end of the long beach and plain in 3,55 ri, making the distance to Otarunai about eight ri, or 20 miles, instead of the twelve ri we had come. It will be possible then to cross from Iwanai to Otarunai in a single day. The improvement is a vast one and can scarcely be too highly commended. Perhaps many others of the old roads of Yesso with good engineering might be in like manner very much shortened as well as better graded. The saving thereby in the labor of travellers would in a year amount to a large sum, and go far towards making up for the expense of the work and possibly even exceed it.

The next morning (17 October) was very cool with a heavy white frost on the ground. We rode on to Iwanai, seven ri. The road following the crest of a narrow nose-like ridge climbed about a thousand feet in a mile and a-

half to the top of a pass in the main ridge, about 1300 feet above the sea, and then descended rapidly a narrow ravine. Some 300 yards from the top we noticed last year in May an outcrop of dark shales, probably tufaceous, much broken up by cleavages with a dip of 30 degrees S. 50 degrees W. (?). About 150 yards below that we found tufaceous, probably trachytic, greenish-gray pebble rock with pebbles of pea size, cropping out also at two or three points just beyond. As we descended, the valley grew wider and wider and less and less steep. After crossing the stream several times, and then a few low hills, we came out upon a wide open plain, which with some undulations and a gentle general descent lasted all the way to the outskirts of Iwanai on the seashore. The plain has the appearance of a fine place for farming, though perhaps a little dry in the midst of summer. Up to the beginning of the prairie the country had been wooded all the way from near Yoichi with generally rather light timber.

From Iwanai I went in the afternoon with a fresh horse to the Kayanoma coal mines (3½ ri) and back, to point out according to your instructions received at Otarunai the place where it would be best to begin a new drainage drift upon the main coal bed at the lowest water level. Owing to the absence of the map left in Yedo, and to imperfectness of recollection of the facts, it was impossible to point out the place with perfect certainty, but a promise was given to write more satisfactorily from Yedo after consulting the map again.

I found them sending coal from the mines to the sea shore, two miles, in mat bags on horseback, and a horse-path had been made for the purpose alongside of the two lower inclined planes. Such a practice was explained by the statement that ropes for the planes had failed to arrive from Yedo. The coal so expensively carried is, however,

in good lumps, less broken up than it formerly was in the two sets of cars used on the upper and lower railroads. I improved the opportunity also of visiting for verification a certain point on a hill where a mistake in the topography of the map had seemed possible. Also in passing Chatsunai I found by inquiry of half a dozen fishermen just pushing off in a boat that the bottom of that harbour and of Shibui harbour and of the space outside was really nothing but rock, as I had last year taken for granted, and that it was bad for anchors. The coarse, tufa, pebble rock there has black or very dark-gray pebbles of trachytic porphyry, with much of what seems to be sanidin weathered opaque white.

By good luck, therefore, there was nothing to detain us longer at Kayanoma. On returning to Iwanai at half-past six, I found the servants and baggage had all arrived; but quite late on account of the badness of the roads. The day's journey including the trip to the Kayanoma coal mines amounted to 35 miles (14 ri).

Yedo; 10th November.—The next morning (18th Oct.) after trying in vain to get from the post station a decent horse to ride across Raiden Mountain so as to relieve my own nearly worn-out one, I set out for Kuromatsunai 30 miles (12 ri) distant. The first ri was easy enough along the sea shore on a rough street lined with houses under a low bluff, the edge of a beautiful example of the bluff deposit. When looked at from a little distance the nearly flat ground above may be seen to slope very decidedly but uniformly from the mountains behind, especially from the mouths of gorges or narrow valleys in them, down to the sea, which has cut into it and left a bluff of varying height. There is no appearance as if the land above the the bluff had been the gentle beach-like slope of the bottom of the sea near land, and it cannot be called properly a sea terrace. Below the bluff, however,

is a narrow strip that is ten or fifteen feet high, above the sea and out of the reach of the waves except possibly in the very highest storms; and that may perhaps be a sea terrace. A similar one, perhaps a trifle higher and having a steep bank or cliff on the seaward side and exposures of rock, may be seen between Rurumoppe and Mashike, and seems necessarily to be a sea terrace, and to show that the land has been rising in comparatively recent times. The only other genuine terraces observed in Yesso were those mentioned last year near Idzumisawa (between Hakodate and Matsmai) and those near Fuurebets spoken of above; and they may possibly be the rare relics of sea terraces showing a rise of the land to a considerable height, a fact which would correspond well with the comparatively smooth outline of the present coast and the consequent rareness of harbours; but also may possibly be explained as lake or river terraces, as already described.

About the end of the first ri from Iwanai, the road leaves the seashore and climbs up the bluff and the gently rising land above to a height of about 200 feet, about half way between the sea and the mountains behind, then descends steeply and crosses a narrow deep ravine. Just above the place where the road crosses the small stream there is a cliff about eight feet high, and a hundred yards below, another about twenty feet high (as observed last year in June) of soft brown (probably sand-rock in layers about three feet thick, of very recent look and about level in dip. It belongs, most likely, to the Toshibets group of rocks.

The road then begins the serious climbing of Raiden mountain and rises pretty steadily and often very steeply keeping commonly on the ridge of a spur of the mountain until a height of about 240 feet above the sea is reached, far above the lowest point of a pass on our left.

At less than quarter that height we passed a small exposure of what seemed to be a greenish trachytic porphyry with sanidin and pores where perhaps hornblende was and with a dip (observed last year) of 10 degrees N. 60 degrees W, But possibly it was not in place ; for a couple of yards forward is a mass of the same rock that is about level in dip and seems equally in place. About two ri from Iwanai and a couple of hundred yards short of a solitary house and temple by the roadside there is an exposure of bluish-gray trachytic porphyry with sanidin crystals and with a dip of 20 degrees N. 55 degrees W.

From the summit the road descended very rapidly to the Yunai hot sulphur springs at the bottom of a narrow ravine about 1100 feet above the sea, as taken with our barometers last year, and about three ri from Iwanai. From a quarter to three-quarters of a mile short of the springs along the road, there were large blocks of a vesicular rock with white rounded pebbles, perhaps of quartz, in a brown compact feldspathic paste ; but none of them were in place. The springs and the unworkable gypsum a mile or so ("10 cho") up the ravine are mentioned in my report of last Christmas. Without stopping therefore at the nice little hotel I hurried on as fast as the rough steep road would permit, having to lead the horse a great part of the way, both for greater speed and in order to save him for the longer rides of the next two days. The road from Yunai to Oshamambe was new to me, while those from Ishcari to Yunai and Oshamambe to Hakodate had been passed over before, parts of them even three or four times.

The road rose rapidly to a height of about 1,950 feet above the sea, and then with some undulations to about 2,150 feet at a point from which there was a fine view of the lower part of the Shiribets valley with its broad, meandering stream of silver, as it seemed,

After that, the road descended very steadily and often steeply along the crest of a long nose of the mountain until the sea shore was reached, about two ri from Yunai. Close by the foot of the mountain there were, near the road, some small cliffs of greenish-gray, compact, hard trachytic porphyry with sanidin, dipping 30 degrees S. 70 degrees W. The road kept on across a grassy plain a few hundred yards back from the sea and separated from it by low wind blown sand hills of some fifteen feet in height, now covered with grass ; and in half a ri reached the bank of the Shiribets river, and a small village near its mouth. We crossed by a ferry and at once began to climb a steep hill to the height of about 300 feet above the sea; and then descended still more steeply by a narrow ravine to the seashore again passing on the way down an exposure of shaly, white sand rock (pale green when fresh) probably of the Toshibets group, with a dip about level. The road then lay along the sea shore below grassy bluffs of perhaps 50 feet in height, and was lined with houses almost all the way to Esoya, about a ri from the Shiribets. Several hundred yards, however, short of the village, the houses became at one point much fewer owing to the narrowness of the space for them left by the bluffs, and by low cliffs of the greenish-gray sand rock (with some harder brown ribs) of the Toshibets group.

By some singular arrangement the hotel (old honjin) of Esoya, although inhabited refused all entertainment for man or beast and pointed to a place some distance back, where no one had been waiting to receive us in the usual manner. But the road was long enough without turning back, and we passed on without refreshment. As far as Odashuts, a ri and a third, the road still kept along the seashore, often among houses, but often on ground too rocky or narrow for them, always

at the foot of bluffs or even cliffs. Here and there some hard ribs of volcanic rock, coarse tufa with pebbles half a foot thick of very dark-gray trachytic porphyry with sanidin, reached from the bluffs across the road into the sea, and formed there reefs near the shore. Between such ribs, however, there were some low cliffs of greenish-gray sand rock of the Toshibets group. Near Odashuts the hills retreated further from the shore and became high mountains; the widened space for houses was filled by a long village. Without testing the hospitality of the Odashuts hotel at so late an hour as the roughness of the roads had caused (half-past two), I rode on and in a few hundred yards reached the point where the road leaves the seashore near the head of a bay. The road then for a mile or two justified the previous expectation that it would be smooth, hard and free from stones, through a plain all the rest of the way, three or four ri. But what a disappointment was in store! After passing a small farming village the road became horribly bad, cut up into high transverse ridges with mire between, the result of the horses' habit of stepping in one another's tracks on soft ground. There was no improvement nor variation except for very short distances through miles and miles together, and the side paths that had been made alongside among the bushes were about as bad. Progress was extremely slow, and at half-past four the goal was still about two ri distant, when two tempting tea-houses were passed. It was already past six and dark when a large brook had to be forded; half an hour later a still larger stream close by the Kuromatsunai hotel. My two travelling companions did not arrive until somewhere about ten o'clock, and the servants and baggage not even then.

The valley we had come up from the sea was a wide open one, but with high hills some furlongs back on either

side. Before coming to the tea-houses we had passed near a mountain of perhaps 800 feet in height on our right. The road after that was hillier than before. The country was covered with thick bamboo along the road, and there were some high woods.

On rising about half-past five the next morning (19th Oct.) my surprise was very great to find that the servants and part of the baggage had arrived only a short time before, after travelling over those terrible roads all night; the second night lately that the faithful "boy" had gone through a like experience.

Yedo; 13th November.—Leaving the baggage and servants to follow as fast as they could, we rode forward to Yamukushinai, 38¾ miles (15½ ri). The first six ri, as far as Oshamambe, were in great part as bad as the road of the night before; except a ri or so of hard stony ground at the beginning, which my horse was too stiff and foot-sore to get much benefit from as regards speed. We succeeded, however, in arriving at Oshamambe on the shore of Volcano Bay by half-past twelve, after more than five hours and a-half of riding. About the end of the first ri we passed the highest point in the whole way across the neck of the great southern peninsula of Yesso, and it was only about 400 feet above the sea; and that seemed to be some distance above the lowest place in the dividing ridge. The road all the way was on the right side of the main valley and crossed many small side streams. Not until perhaps a ri and a-half short of Oshamambe did the road come close to the river of the same name, and scarcely within sight of it again. Both to the right and left at the distance of a few furlongs there were moderately high hills or even mountains in sight. The timber seemed everywhere to be light.

After lunching and seeing the horse well-fed and rested for two hours at Oshamambe, I rode on again, along the

good sea beach, remembering that part of the road from last year, and counting greatly upon it for speed. For nearly eight ri indeed, almost as far as Yurap, the horse accomplished two ri an hour.

At first we had bluffs of perhaps 75 feet in height a quarter of a mile back from the shore with a flat grassy plain below them and mountains 500 to 1,000 feet or more in height a quarter of a mile behind. The sand on the shore was in part white and coarse, and looked as if it came from syenite. At the end of three ri we crossed the Kunnui river with its little Aino village, opposite a pretty wide gap in the hills and mountains; and in another ri or so passed a few more Aino houses; but the long beach is little inhabited. The hills, perhaps 300 feet high, and the bluffs before them, still some 75 feet high, soon after that approached each other and the sea shore until both reached the beach at Kuroiwa (black rock), and were continued in some large blackish rocks that jut a hundred yards into the edge of the water and give the name to the little village and hotel a hundred yards beyond.

It was the only rock exposure in the whole day's ride, and I stopped a few minutes to look at it again. It is evidently the place which Mr. Blake in his report to you of April, 1872, mentions as Shiraika (Shirarika is just beyond), where he says there was "an outcrop of a black siliceous rock and of a sand stone totally different from it, and beyond, a dyke of amygdaloidal rock, lava like, in which are large agatized siliceous masses." The sand stone is light brown and horizontal in the bluffs here and for a few hundred yards beyond, and belongs probably to the Toshibets group. The "black siliceous rock" and the amygdaloidal rock" I take to be the rock on the shore, and the 20 foot high cliff of the same rock near the top of the bluff close by; but although the stratifica-

tion is much obscured by cleavages the rock seems hardly to form a dyke. As observed last year in September, the dip in the cliff appeared to be 80 degrees N. 30 degrees E.; in the rock on the shore, 80 degrees S. 45 degrees W.; and the course from one exposure to the other to be N. 50 degrees W. A hasty independent observation this year gave the strike of the rocks on the shore as roughly S. 40 degrees E. According to last year's observations the rock on the shore is a very hard, but rather friable pebble rock of jaspery looking, but really feldspathic very dark brown almost black pebbles of irregular more or less rounded shapes, egg size and less, cemented together by the same material and containing numerous white masses of chalcedony from the size of a mustard seed up to that of a turkey's egg. These masses are in the pebbles, but sometimes perhaps form pebbles themselves. The rock of the cliff is in parts less pebbly and is of green, veined, gray weathering, jaspery looking material; but is in other respects just like the rock on the shore and contains just such masses of chalcedony. In the rock on the shore those masses look strikingly like imperfet fossils, most of them very imperfect, so rounded as to lose almost all character; but in some cases seem almost recognisable. One, for example, appears to be a terebratula of the size of a filbert; one looks like the head of a crinoid with a portion of the foot stalk preserved; others look a little like echinoderms. There are also some thin veins of chalcedony running though the rock.

A ri or so beyond Kuroiwa the bluffs and hills on the right disappeared, at the side of the broad flat valley of the Yurap river. Along here the beach was soft and progress rather slow, and it grew dark. A ri beyond that we left the beach and took the still softer sandy road a few hundred yards from the shore thinking to come soon to the Yurap ferry. The poor horse finding a good

soft place in the road deliberately dropped down with fatigue, and I had to lead him to the ferry and part of the way beyond. His exhaustion arose not so much from the excessive length of his daily journeys, as from the prevalent dense ignorance everywhere as to the proper manner of feeding and caring for a horse that was working so steadily. Special gratuities to the hostlers had produced little or no effect, and that evening it was necessary in addition to see personally that the needful food and water were given him.

It was half-past eight by the time we had crept along in the moonlight so far as Yamukushinai. The road was level and sandy, along the beach or close by and passed near the old ironworks and over the iron sand deposit which are mentioned in my last winter's report. Nearly a mile short of Yamukushinai a small reef of light gray slightly brownish coarse grit, in part even a pea pebble rock, was observed last year to have a dip of 25 degrees N. 50 degrees E.; likewise another half-way between that and Yamukushnai of the same materials, but still coarser, and somewhat crossbedded, with a dip of 25 degrees N. 60 degrees E. Apparently the same rock with a dip of 25° S. 60° E., but very recent looking and containing a trace of oil was observed at a place 400 yards south of the main oil well. The rocks all probably belong to the Toshibets group.

The bluffs back of the village, 150 yards from the sea, rise to a height of perhaps a hundred feet and have a nearly level plain at the top for half a mile back, and then slightly higher ground reaches perhaps a mile further to moderately high mountains. The plain above the bluffs was nearly open, but did not look very fertile, yet might do for a pasture.

The next morning (20th October) without stopping to look again at the oil springs of Yamukushinai already

spoken of in last year's report we set out for Hakodate, 43¾ miles (17½ ri). The same bluffs interrupted here and there by streams continued as far as Otoshibe (2ri); and the road lay along the beach most of the way. The horse was still tired and stiff, so that we went along very slowly. It was necessary therefore after all to give him up and take a post horse at Otoshibe, and the change was made as quickly as possible. The new horse proved a prize in the lottery, and took me rapidly to Mori (4 ri), past Washinoki with its oil and its limestone described in the report of last Christmas. The road was almost always on the beach, alongside of high bluffs with many exposures of the greenish-gray soft sand rocks of the Toshibets group. Here and there a small village was passed through, where the mouth of a valley gave space for one.

At Mori it was necessary to change horses again according to rule; and this time a blank was drawn in the lottery. It was a violent kicker and one that being accustomed only to follow others in a train could only with the greatest difficulty be urged past any horse we overtook on the way. We had however the New Road to travel on, and succeeded in climbing over the dividing ridge about 1000 feet high, and descending to Togeshita at the rate of about two ri an hour. It was impossible of course to enter Hakodate with such a horse, even if he had not been already tired out, and another change was made at Togeshita, and a real prize obtained. For I insisted on riding the horse of the horse boy that was sent with me; and found he had chosen very well for himself. In that way we rode past Nanai farm with its buildings that now look so neat from the road, and then down the long descent into Hakodate, and arrived soon after five o'clock, less than 27 hours from Oshamambe (27 ri).

On the Mori side of the dividing ridge the only rocks noticed were pumice from the Komangadake Volcano near by. Above Togeshita there was an exposure of an older looking volcanic, reddish, probably feldspathic rock with a dip of perhaps 45 degrees westerly.

The road was having many of its small bridges renewed. Near the top of the mountain were still to be seen the only half obliterated traces of the cross ruts made by the horses in the mud of last winter. If not repaired properly the effect must be still worse this winter.

In the fifty-three days from Nemoro to Hakodate my travelling amounted to 819 miles (327.6 ri), an average of 15,45 miles (6.18 ri) daily. Taking out the ten days of the boat and foot journeys (96½ miles, or 38,6 ri), necessarily much slower though requiring more hours each day, the daily average of the rest was 16,80 miles (6,72 ri) ; rather more than what is considered a good average for cavalry men, or for the horses of street railways. The extreme roughness of much of our roads should also be borne in mind, as well as the fact that all the topographical and geological work (including the gathering of very numerous rock specimens) and some mapping were done in the same time, besides about 100 pages of this report written and copied and thirty odd pages more of the rough draft finished. The work to be sure with the exception of the last few days was less severe than that of last autumn, and intentionally so ; not because the efforts of that season seemed to be wholly unappreciated and taken as a matter of course, but because it was physically impossible to repeat them. The comparative exhaustion they produced, together with the lack of any good rest through the winter and the fatigues of the Ishcari trip eventually brought on such extreme emaciation as peremptorily demanded a better care of health, which happily resulted in an average gain of

about half a pound of flesh a day all the way from Nemoro to Hakodate.

Yedo; 14th November.—Messrs. Day, Munroe and Boehmer were at Hakodate on my arrival, and we all occupied the same house. Mr. Munroe reported verbally that he had written me two or three letters not yet received; that he had finished the gold survey at Ichinowatari near Matsmai (not the Ichinowatari near Ono) without any very good prospect of workable gravel; that he had afterwards taken his party to Birô and Berufune, but with careful washing of large quantities of earth there and at various other points along the coast had found scarcely a trace of gold; that he had then according to instructions taken the party to the Mombets coal field, and after setting them fairly at work there had himself started for Yedo in anticipation of the termination of his agreement with the Kaitakushi; that there were only comparatively thin beds of coal so far discovered on the Mombets, but that they were said to be the best of all that region. After his arrival in Yedo from his trip hither overland, I shall be able to give you fuller particulars of his season's work.

* * * * * * * * * *

While at Hakodate Mr. Boehmer gave an account of some very interesting Aino customs that he had observed. He and his Japanese travelling companions had gone from Saru (beyond Yubuts) five ri up into the country, as far as the tomb of a Japanese named Yoshitsune, who lived 700 years ago, and was exiled from Nippon. At the grave on a wide stream is a small temple, as large as a table of middling size; and the memory of the dead man seems greatly to be venerated by the Ainos. There were seven Aino villages on the road, each with its chief and the principal chief of them all was in the uppermost village; and the party was received there in his house by

all seven chiefs. He was a man fifty or sixty years old; the others were said to be over eighty and had white hair and beards. They were dressed expressly for the occa-occasion in handsome robes embroidered with blue and wore crowns of straw decorated with red flannel and bits of tin. The house was unusually large perhaps forty feet by thirty; the floor was covered with colored rush mats; dried salmon hung aloft; on one side behind the fire place were raised beds with deer skins, not too cleanly looking; though the house in general was much neater both inside and out than the common Aino houses, and was very neatly thatched. Within were Japanese gifts that had accumulated for perhaps a score of generations, old swords, rice dishes and lacquered ware; the oldest much the best and very handsome, the newest merely plain lacquer. The visitors ate the lunch they had brought and the Ainos drank some of their own sake, which the others found quite too bad to drink. The Ainos in drinking raised their heavy moustache with a small stick, somewhat like a paper cutter, made for the purpose and sometimes neatly carved. Before parting the guests made a present of a rio delicately wrapped up up in paper; but it was quickly opened without ceremony, and half rio more demanded so as to buy a whole keg of saké.

The next morning on the sea shore some of the Ainos made a prayer to the sea god to quiet the swollen waves and to send back two boats that had gone out each with two Ainos a couple of days before. The same day an Aino boat that went in search of them brought back one boat, but the other seemed to be quite lost. The two rescued but half starved men were fed on the sea shore, and towards sunset there was a singular dance on the beach. The Aino men of the village formed one line and the women another, and with poles like lances in their

hands went through with many evolutions. Sometimes they would make as if charging with their lances against the sea. Then there was another prayer by an old man facing the sea. After sun down all hope for the other boat was given up, and according to custom the women in all the neighboring five villages devoted themselves to lamentations which they kept up the greater part of the night. They squatted in pairs on the ground facing and hugging each other, and wailed and shed tears. The men did not join in the crying, and the women did not except while squatting.

Our servants and baggage and the old horse did not reach Hakodate until the 21st of October, a whole day after my arrival. The 22nd, 23rd and the morning of the 24th, some progress was made in copying this report and in writing the rough draft. About noon of the 24th we sailed for Yokohama in the steamer Courier, arrived there on the 27th, and came at once to Yedo, The two parties of Japanese assistants were to reach Hakodate before the first of November, but have not yet arrived here. No information has come to me from the one in the Ishcari valley since I wrote you from Nemoro.

Here then at last I bring this report to a close. You will say perhaps that it is a report not only on the geology of our route but on matters and things in general; and that it ought to bear the Shakespearian motto "Sermons in Stones," or rather "Sermons and Stones."

In case perchance through impatience to read the essential record of geological and topographical facts you should have skipped over the rest, I would beg to ask your attention at least to what has been said about the lessees and merchants who receive loans, that handful of monopolists who seem really to possess the island more thoroughly even than the Kaitakushi itself does. The subject, however, is very likely not new to you since it

would be natural enough for the Kaitakushi, immediately on securing your aid as an Adviser, to inform you fully on all matters of such extreme weight in its concerns. Still, some points may have been overlooked, as men often forget the importance to others of information that has long since become familiar to themselves.

* * * * * * * * * *

I have the honor to be,
Sir,
Your most obedient Servant,

BENJ. SMITH LYMAN,
Chief Geologist and Mining Engineer to the Kitakushi.

Yedo ; 23rd November, 1874.

GEOLOGICAL SURVEY OF HOKKAIDO.

REPORT

OF A

ROUGH SURVEY

(IN 1873)

OF THE

YAMUKUSHINAI OIL LANDS, IN YESSO,

BY

BENJ. SMITH LYMAN,

CHIEF GEOLOGIST AND MINING ENGINEER TO THE KAITAKUSHI.

Accompanied by a Geological and Topographical Map.

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1.—SITUATION.
2.—LAY OF THE LAND.
3.—GEOLOGY.
4.—OIL.
5.—WORKING THE OIL.
6.—SHIPMENT.
7.—MAP.

Gen. HORACE CAPRON,
Commissioner and Adviser to the Kaitakushi.

SIR,—I have the honor to make you the following report on the Yamukushinai Oil Lands.

1. *Situation.*—The Yamukushinai oil lands lie in and near the village of that name on the East (or Pacific) Coast of Yesso and on the western shore of Volcano (or Edomo, sometimes called Endermo) Bay, about 15 miles (6 ri) from Mori and 42 miles (17 ri) from Hakodate.

2. *Lay of the Land.*—The Oil Wells are in a low flat-plain about 200 yards (100 ken) wide which reaches from the sea beach to bluffs, 100 feet high above tide, that run nearly parallel to the shore, here north-westerly and

south-easterly. Above the bluffs the land is nearly level, but rises gently to a height of 150 feet or more at half a mile from the shore. This high land is cut into valleys by small streams, particularly by the Yamukushinai Brook on the south-east and by the somewhat larger Okotsunai Brook three-quarters of a mile to the northwest. The village and road run along near the beach, and the oil exposures are chiefly just back of the houses, but in one case close to the roadside. They are all within a space of 100 yards (50 ken) in diameter, nearly half-way from the Yamukushinai Brook to the Okotsunai, except a very small one 400 yards further south in the bank of Yamukushinai Brook.

3. *Geology.*—The exposures of rock in place are extremely few in the neighborhood of Yamukushinai; in fact only three were found. Besides one with a dip of 25° S. 60° E. at six yards up stream from Mr. Kuwada's oil spring, there were two low small reefs in the edge of the sea at about three-quarters of a mile (11 chô) and at about a mile (15 chô) northwest of the Main Well. The dip at the near place was about 25° N. 60° E; at the far one about 25° N. 50° E. On drawing the curve formed by the strike of the beds as indicated by these dips it is seen that the oil of Mr. Kuwada's spring comes in all probability from the same oil-bearing bed as the oil of the other wells.

The curve of the beds of rock from south-westerly to southerly near Mr. Kuwada's well and afterwards south-easterly with dips at right angles to the curve and towards its easterly side shows that the beds lie in the form of a saddle or anticlinal with its axis running north-westerly and south-easterly. The axis sinks pretty rapidly to the sauth-eastward. The oil exposures are at some distance to the north-east of the axes, especially the best ones near the main well; and there is nothing here to confirm the

idea, that some have entertained, that oil is to be found especially abundant near anticlinal axes. The idea arose probably from the fact that in certain regions oil wells of some depth are most numerous near such axes, because in such places the oil-bearing beds rise to the surface of the ground.

Although all the oil exposures are found merely in the alluvial sand or gravel, yet the oil undoubtedly has entered the alluvium from the underlying bed of more solid, older rock. The rock is no doubt that of the Toshibets Group, which is also abundantly exposed between Yamukushinai and Washinoki and around the Washinoki oil springs ; also at and around the Idzumisawa (or Kamaya) oil-springs and at the diminutive oil exposure on the sea shore about a mile south of Atsuta and some four miles north of Ishcaributo. In short, all the oil of Yesso seems to come from rocks of the Toshibets Group.

The rock exposed near Mr. Kuwada's oil spring is a very soft, bluish gray sand rock that weathers brown. It seems likely to be near the top of the oil-bearing bed, while the main well seems to be nearly over the bottom of the same bed. The thickness of the bed appears to be about ninety feet.

The rock of the two dips already spoken of to the northwest in the edge of the sea is a coarse, slightly brownish, light-gray grit, in parts even having pebbles of the size of peas, and at the nearer place still coarser and much cross bedded. The rock of the near reef seems to be just about 1,000 feet below the oil-bearing bed ; and the rock of the far reef about 500 feet still lower. It is probable that all the intermediate rocks and those over the oil-bearing bed are also coarse light-gray sand rock, perhaps rather softer than those that have so remained in reefs. Indeed the Toshibets group, as exposed throughout this region, is

generally made up of soft bluish or greenish-gray sand rocks.

The narrow plain between the bluffs and the beach probably consists wholly of alluvium down to the sea level or thereabouts ; for the sea once no doubt washed the foot of the bluffs ; but reefs of rock may have been left here and there to be covered by the sand and gravel.

4. *Oil.*—The Main Well is about 100 feet back of one of the houses of the village and about 50 yards nearly in front of a Buddhist temple, and was dug in 1872 by the directions of Mr. Enomoto. It is about ten feet square and eight feet deep, and is loosely walled at the sides with wood. The digging was wholly in the sandy, wet, alluvial gravel, and the hole is full of water nearly to the top. Upon the surface of the water we found the oil that had been accumulating during the past year. It was skimmed off and amounted to about 24 gallons (6 to). Twenty-four hours later the oil of one day's yield was skimmed off and found to be a little over three pints (about one sho). The oil (so called) was quite black and very thick and heavy, so as really to deserve the name of tar. Its specific gravity was tested by Beaumé's hydrometer, and was found be that of 11 degrees only. Owing to the thickness of the oil it seemed to be especially good for lubricating machinery, and what we had gathered was sent to Sapporo to be tried in the mills there. Mr. Holt has since told me that it in fact turned out very good for that use.

Within some three or four yards of the well there is a thin layer of hard, dried tar or asphalt amounting to perhaps 25 cubic feet.

Abundant bubbles of gas rise from the bottom of the well.

The Merchant's Well was dug by a private merchant at the same time as the main well, is about 70 yards south

easterly from it and 50 yards from the Temple, and is a hole perhaps five feet across and eight feet deep. It seems to be dug wholly in the same alluvial sandy gravel and is loosely walled at the sides with twigs and is full of water. We skimmed off the oil that has accumulated upon the water during the past year ; but it was too much mixed with sticks and leaves to be good for any thing. Twenty-four hours later we found that scarcely a spoonful of oil had risen to the surface in one day. The oil is in fact thick black tar, just like that of the Main Well.

A small oil well about two feet long by half-a-foot wide and a foot and a-half deep was dug in the same alluvial gravel (in 1872 by Mr. Enomoto, it is said) about 200 feet east of the Main Well, and ten feet back from the southern edge of the road. It is nearly full of water and has a thick scum of black, tarry oil upon it. Near it there is on the ground perhaps a dozen cubic feet of asphalt.

Another small oil-well, apparently an old digging, is six yards southerly from the last mentioned one, and is a dozen feet long by half-a-dozen wide and some three feet deep. It has a thin film of black tar on it.

About ten feet northerly from the Main Well there is a trench some three yards long by a foot and a-half in width and depth. It is two-thirds full of water with a thin scum of tar. Near it is a little more asphalt, say two cubic feet.

On either side of the approach to the Temple, passing between the Main Well on the one hand, and the Merchant's Well and the road-side oil exposures on the other, there is a ditch. In the easterly one there is a good deal of oil on the water, but in the westerly one (towards the Main Well) very little.

Two telegraph post holes, it is said, were dug in 1873 by the road side ; one at a dozen yards northwesterly of

the little well of Mr. Enomoto's by the road, and the other 200 feet farther in the same direction and close by the north-west corner of the house that stands in front of the of the Main Well; and in both much issued, but they were filled up before the time of the survey.

A water well was once dug, they told us, five or six feet deep about ten feet back of the house just mentioned, but was filled up again, because so much oil came into it.

Mr. Kuwada (assistant geologist) also succeeded in finding a small oil-spring in the gravelly bank of Yamukushinai brook at about 400 yards south of the Main Well; but the yield is scarcely more than a mere trace. Within six or eight yards up stream and down stream from the oil there are four or five insignificant cold sulphur springs, yielding a deposit of white slime, apparently sulphur) and enough sulphuretted hydrogen to give out a strong smell. The oil here comes from alluvial gravel.

Oil was found at no other place, but some bubbles of oil gas came from a spring of water in the garden of the principal hotel.

The whole daily yield of oil, then, at all the exposures is probably less than half a gallon (say one sho and a quarter); almost all of it at the main well and scarcely more than traces elsewhere. The asphalt at the different places amounts in all to perhaps forty cubic feet, or say a ton and a half; of which about two-thirds is near the main well, and nearly one third by the small roadside well.

5. *Working the Oil.*—The oil would seem to be chiefly confined in the bed which bears it to a very small space around the Main Well, and to exist only in traces at a greater distance, as at Mr. Kuwada's small oil spring. Although half a mile of the outcrop was included within the limits of the survey no other oil exposures were found; and none are known at a greater distance. If the

bed were rich in oil outside of the immediate neighborhood of the Main Well, it is probable that some sings of it would have been observed here and there in a country that has been so thoroughly explored by its inhabitants.

In making a special search for such exposures, however, it is not now necessary to look in every direction at random ; for the map of our survey shows the probable place of the oil-bearing bed at its out-crop and at lower levels. The course of the out-crop for the first half mile from the seashore is in general southerly as far as to Mr. Kuwada's oil spring, and thence south-westerly. At the Temple it rises south-westerly to the top of the bluff, from which it descends easterly to Mr. Kuwada's spring. The out-crop is over 200 feet wide for the first quarter of a mile from the sea shore, and in the next quarter of a mile, owing to the shape of the ground combined with the dip, widens temporarily to some 400 feet. In the corresponding space the course of a line drawn at a given level (say that of the sea) on the surface of the bed (or say half-way between the top and bottom of it) forms a curve almost like the arc of a circle, hollow towards the west. The dip of the rocks is everywhere at right angles with that curve and towards the easterly side.

The oil-bearing bed therefore dips into the ground only on the easterly side of the outcrop, and it would be useless to search for it to the west. Digging or boring to the westward could at best only reveal some other oil-bearing bed ; but there is no evidence nor probability that any such bed exists there and sinking of wells in that quarter would be only a waste of money. The search, then, would be confined for shallow digging to the immediate neighbourhood of the outcrop as marked on the map, and for deeper wells to the country lying easterly of the line of out-crop,

Shallow wells dug in the alluvial plain, near the Main Well, would encounter much water in the sandy gravel, so as to make the work very difficult. Although the oil seems to be more abundant in that space than anywhere else the cost of digging compared with the small yield of even the Main Well is a complete discouragement to the sinking of any more wells there. If any should however be attempted it may be borne in mind that the edge of the oil-bearing bed below the alluvium would be a few yards easterly of the place where the bed would crop out if continued upwards to the surface of the ground. On the other hand the oil on entering the sandy alluvium would probably spread to some little distance in every direction, like water dropped upon a sponge. Owing apparently to the two causes just mentioned the Merchant's Well and the roadside small wells show signs of oil, although outside of the outcrop as marked on the map.

Following the outcrop, however, southerly to the foot of the bluff, trial pits might easily be dug in the hillside in such a way that they would drain themselves. As such a testing of the oil bed at its outcrop would cost very little it may be thought worth while, although there is not much prospect of finding a good yield of oil. The place to dig near the foot of the hill is all the way from the western corner of the temple to a distance of a hundred yards south-easterly. There seems to have been no well dug at the Temple, but within the space just described at least two post holes for the telegraph line, as finally fixed just in front of the temple, were dug below the foot of the bluff without apparently finding any trace of oil. Nevertheless there may very likely be just below the hill a pretty thick mass of loam that has slipped and been washed down the hillside in the course of time; and as such loam would be less pervious

to the oil than the light sandy gravel of the plain below, the post holes may for that reason have failed to find any traces. Higher up the hill side (south-westerly) the loam would be less thick, and a shallow horizontal digging would probably reach even to the solid rock and show whether the bed contained oil there. Similar trial pits might easily be dug along the outcrop in the steep hill-sides to the east of Mr. Kuwada's oil spring and on the easterly side of Yuoi Brook for a quarter of a mile at least up stream from that spring. The probability however, is that the traces of oil would be smaller and smaller the greater the distance from the Main Well, until they disappeared altogether.

But if the result of such an easy test of the outcrop along the hill sides should contrary to reasonable expectation prove encouraging, then borings of some depth might be made upon the oil-bearing bed of rock to the dip, that is, on the easterly side of the outcrop. The dip near the main well would bring the bed to a depth of 100 feet easterly below the sea level at a distance of about 175 feet easterly from its position at sea level ; to a depth of 200 feet at twice that distance or 350 feet ; and so on. Half a mile southerly from the main well along the course of the bed the dip is gentler, and would cause a difference of 100 feet in level only at a distance of about 250 feet south-easterly. Besides the depth below the sea level at which the bed may be counted upon at any point, the height of the ground there above the sea must be borne in mind in order to estimate the full depth of the well.

It would be best at first not to bore so far away from the outcrop as to need a very deep well ; the cost would be too great to be justified by the very uncertain prospect of success. The first wells bored, therefore, should not be more than a hundred feet ,or at most 150 feet or so in depth. They could be bored by hand with

light boring apparatus that would make a hole of two inches and a half or three inches (0,25 shaku) in diameter. If such wells proved a grand success (contrary to what might be expected), then by degrees deeper and deeper ones might be bored at greater and greater distnaces easterly from the outcrop. In that case, for very deep boring, where boring by hand would be very costly, some heavier more complicated machinery might become advantageous. But such a result is extremely improbable; and moreover the transportation of heavy machinery would require the building of roads such as do not now exist anywhere in the region, and keeping the machinery in repair would be very difficult at such a great distance from anything like machine shops (at Sapporo, Hakodate or Yokohama).

In sum, then, it is highly improbable that well boring could ever be done here to advantage, still less very deep boring; but some shallow trial pits could easily be dug along the outcrop in the hillsides in order to test the oil-bearing bed of rock. Here is no likelihood whatever that the bed would prove richer in oil at a great depth than it is along the outcrop. The richest part of the bed is probably close about the Main Well and the small road-side wells.

6. *Shipment.*—The facilities for shipping the oil (in case it should ever be found in large quantities) are not very good. There is however a pretty good, nearly level road for pack-horses along the shore of Volcano Bay to Mori; and thence the new wide road to Hakodate, the nearest harbor. At Yamukushinai there is not a trace of a harbor; but in fair weather a vessel might lie off the shore and be loaded with oil barrels from small boats. The water is shallow and the exposure towards the east winds and the open Pacific is complete.

7, *Map.*—The surveying for the map was done by Messrs,

T. Yamauchi, T. Kuwada, J. Takahashi and T. Saito, Assistant Geologists, before my visit to the place, and consequently with only very general instructions. The work was done with imperfect prismatic compasses and pacing; but the unavoidable errors were probably of little consequence for the object aimed at. For the different topographical points laid down on the map can at the most (even by accumulation of errors) differ but a few yards from the truth, whereas the inevitable geological uncertainties would commonly lead still more largely to inexactness in the results; as, for example, in estimating the depth of the oil-bearing bed of rock at any given point.

The map shows the shape of the ground by contour lines drawn ten feet apart in level; showing, for instance, what would be the shore line if the sea should rise ten, twenty, thirty or any other number of tens of feet; such lines of course come very near together on a steep hillside, but are far apart on nearly level ground. By means of the contour lines the height of the ground at any point, even between them, can be closely estimated. A knowledge of the height of the ground is necessary not only in determining the relative geological position of the rocks exposed, and the place of the outcrop of the oil-bearing bed, but in estimating the depth of the bed at any given point before boring there.

The depth of the oil-bearing bed below the sea leve is shown on the map in the same way as the shape of the ground is shown, by curves (or contour lines of the bed) drawn at 100 feet apart in level. As the shape of the bed, a large saddle, or the top of a wave, is far more simple than that of the surface of the ground, its curves are much more regular and nearly parallel and equally distant, and could hardly be mistaken for the surface contour lines. But in addition they are drawn with

broken lines to prevent the least possibility of confusion. They show at a glance what portion of the country represented by the map is underlain by the oil-bearing bed; and their absence in the rest of the map shows where it would be wholly useless to dig or bore.

The probable place of the outcrop of the oil-bearing bed of rock is marked on the map by straight, nearly parallel lines, drawn across the outcrop about at right angles with it. The outcropping edge of the bed of rock is, however, covered almost everywhere by a greater or less thickness of sand, gravel or loam, especially in the narrow plain between the bluffs and the sea; where such loose alluvial matter amounts to several feet (perhaps a dozen or more) in thickness. As the outcrop is marked as if the bed reached to the surface, its upper edge really to be found under the alluvium would be a few feet more easterly.

As there are no roads except the main one near the sea shore, the lines of the survey were mostly straight ones cut through the woods at right angles with one another; but the sea shore and Yuoi Brook were run in addition. On each straight line stakes were set up at every 200 feet, and their level taken; and they would be of great use in finding upon the ground any point that may have been selected on the map. For that purpose also each stake has a mark of its own; namely, a small letter of the alphabet besides the page (or folio) and volume of the surveyor's note-book and his initial (Q for Kuwada.) As there are in the note-books but 99 folios, the volume is indicated simply by a digit preceding the two used for the folio; as "213", for the thirteenth folio of the second volume. On the map the surveyor's initial and the page number are written only once for each line, and the small letter for each stake; but the last digit of the number is given where a new page was begun.

Besides the stations marked with stakes many others were fixed in position and level, where there was some change in the shape of the surface, such as a summit or a stream. The position of many houses, too, was fixed and mapped, when they were near the lines; but some at a greater distance have been omitted. Such fixed points as these are of course even better than the less-permanent stakes for finding on the ground any desired place that is marked on the map.

On the same sheet with the map is a cross section passing through the Main Well at about right angles with the strike, and showing the position of the rock beds with their easterly dip, especially the place of the oil-bearing bed.

Each of the surveyors plotted his own line and drew the neighboring contours; but Mr. Kuwada has had special charge of uniting the whole finally into one map with the adjustment or correction of the various errors. Mr. K. Makino has traced the map in strong black lines upon white cloth in such a manner as to be well suited for copying by photography. The lettering has been done by Mr. S. Misawa. The final mapping has all been done under my own eye and guidance.

It has seemed especially necessary to explain the different features of the map so minutely to the Kaitakushi because, while we have a number of others like it nearly done, it happens to be the first one of the kind yet finished in Japan.

I have the honor to be,
Sir,
Your most obedient servant,
BENJ. SMITH LYMAN.
Chief Geologist and Mining Engineer to the Kaitakushi.

Yedo; 17th April, 1875.

ERRATA: On pages 2 and 6 instead of "Yamukushinai Brook" read Yuoi Brook, and instead of "Okotsunai Brook" read "Yamukushinai Brook."

GEOLOGICAL SURVEY OF HOKKAIDO.

REPORT

OF A

ROUGH SURVEY

(IN 1873)

OF THE

IDZUMISAWA OIL LANDS, IN YESSO,

BY

BENJ. SMITH LYMAN,

CHIEF GEOLOGIST AND MINING ENGINEER TO THE KAITAKUSHI.

Accompanied by a Geological and Topographical Map.

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1.—SITUATION.
2.—LAY OF THE LAND.
3.—GEOLOGY.
4.—OIL.
5.—WORKING THE OIL.
6.—SHIPMENT.
7.—MAP.

GENERAL HORACE CAPRON,
Commissioner and Adviser to the Kaitakushi.

SIR,

I have the honor to make you the following report on the Idzumisawa Oil Lands.

Situation.—The Idzumisawa Oil Lands lie close by the sea shore about a mile (half a ri) easterly from the village of that name in Oshima province, Yesso, and still nearer to the small village of Kamaya on the other side; and about 12½ miles (5 ri) westerly from Hakodate.

2. *Lay of the Land.*—The sea shore just against the oil lands runs north-easterly and south-westerly and is met nearly at right angles by two or three very small

brooks. The land between the streams rises from the sea in three broad terraces with rounded edges some 120 feet, 180 feet and 228 feet high within a distance of about half-a-mile ($\frac{1}{4}$ ri); and less than a mile further back becomes a hill some six hundred feet high. The little valleys are very steep-sided with here and there small cliffs. The land is almost wholly open, covered with grass or at most low brush in spots, and scarcely a trace of forest trees. There are no dwellings within the limits of the survey.

The oil exposures are wholly within ten yards of the Main Well, about half-a-mile from the sea shore; and are only in holes dug there in the bottom or sides of a little valley only a few yards wide.

3. *Geology.*—In the beds of the streams there are pretty numerous rock exposures; and the dip shows very clearly the structure of the rock beds to be that of a great saddle or anticlinal with the axis about 1000 feet east of the Main Well and running north about 15° (magnetic) west and sinking steeply towards the corresponding southerly direction, and still more steeply so near the sea shore. The dips on the westerly side of the axis are generally about twenty degrees; but also grow steeper up to 30 degrees or perhaps even 45 at a distance of half a mile or so from the axis. On the easterly side the dips are some 65° at 250 yards from the axis and three-quarters of a mile from the sea, but only 45° at 100 yards from the axis. The dips on the axis seem to be about 20 degrees at half-a-mile from the sea but growing steeper to 25 degrees, 30 degrees or even more at 250 yards (125 ken) from the sea. There are perhaps some smaller undulations on the sides of the main saddle, which would account for a few irregularities of dip as observed; but these can also be well accounted for by the uncertainties of the observation in those cases; for the true direction

or amount of the dip was sometimes very hard to make out.

The rocks doubtless all belong to the Toshibets Group, and are chiefly soft greenish-gray sand rock. Although the beds of this group here and elsewhere are folded with such steep dips, some of them at other places contain fossils which have a very recent look; and they probably belong to a late Tertiary period perhaps newer even than the Miocene. Here, however, the only fossils found seemed to be small serpulae the same as are found near the Yurap Lead Mines. At Tomigawa only ten miles (4 ri) from the oil towards Hakodate the same group of rocks contains a thin (one foot) bed of lignite, far more recent-looking than the coal of the Horumui Group, which can itself be hardly older than the Tertiary.

The oil-bearing bed seems to be not more than ten feet in thickness. All the other beds of rock, exposed here and there through a thickness in all of about 1,700 feet reaching to about 1,000 feet below the oil-bearing bed, are chiefly soft bluish-gray sand rock weathering first greenish gray and then brown; sometimes the rock is a pepper-and-salt gray sand rock; sometimes it is a bluish-gray sandy shale. The fossil serpulae are very abundant and are found at almost every exposure.

4. *Oil.*—The Main Well goes through the alluvium into the rock below, and is nothing but a hole about four yards long by a yard and a half wide and two yards and a half deep, about half full of water and with no curbing. The oil comes almost wholly from the west corner where bluish-gray rather coarse, somewhat shaly, broken sand rock containing bright-green specks and apparently traces of fossil serpulae is exposed above the water to a height of two feet. The rock at that point has been undermined so that there is at low water a cave perhaps three feet and a-half deep towards the south-

west. The alluvium there above the rock seems to be quite free from oil; which however drips from the part of the rock exposed above the water. About 82 gallons (2 koku 1 to) were taken at the well as the accumulation of a whole year past; and for three days afterwards an average of two quarts and $2\frac{3}{4}$ gills ($1\frac{1}{2}$ sho) were obtained. The oil was like that of Yamukushinai black and very thick and so heavy as to mark eleven degrees of Beaumé's hydrometric scale. No doubt such thick oil would be especially valuable for lubricating machinery.

Another large hole some five yards down stream (S.E.) from the Main Well has but little oil on the surface of the water. The oil there comes clearly from the bluish-gray sand rock, which becomes greenish-gray in weathering brown. The alluvium in the upper part of the hole yields no oil.

Much nearer to the Main Well and between it and the brook are two holes about 3 yards long by a yard wide dug wholly in the alluvium. The down stream one has a thick continuous scum of oil upon the water; the other has only a trace of oil.

About eight yards above (west of) the Main Well a hole of about three yards in diameter has been dug in the hill side exposing bluish-gray sand rock with a dip of 20° S. 40° W.; but no oil was found there.

The oil at all the exposures is of the same color and character as that of the Main Well; and the yield of that well may be taken as the whole yield of them all. No asphalt nor gas was observed near them.

5. *Working the Oil.*—So very small a yield considering the number of holes that have been dug, gives little encouragement to further trials by digging and still less by boring; especially as the outcrop of the oil-bearing bed is very extensive in the space surveyed, to say nothing of the surrounding country, and has so far nowhere

been found to contain any oil. If rich in oil anywhere but at the Main Well, it would no doubt have given rise to oil springs as it did there. Even if the rock itself were covered with a little alluvium, the oil would have entered such porous gravel or loam and have made itself seen and smelt in a region that has been so thoroughly examined not only by our surveying party but still more widely by the inhabitants.

If, however, it should be desired to test the bed by digging, its outcrop could easily be opened along the south-westerly bank of the small brook for about 700 yards up stream (north-westerly) from the Main Well. There the outcrop seems to cross the stream and to run northerly about 400 yards up to the hill top. In the other direction from the Main Well the out-crop runs about 400 yards south-easterly, and then about N.N.E. for 600 yards at least. The outcropping edge of the bed is probably nowhere covered by any very great thickness of alluvial matter, especially on the steeper hill sides, so that the solid rock could no doubt easily be reached by digging. In most places, too, the pit could be so driven into the side of the hill as to drain itself, and let the water give no trouble. The result of a trial of the outcrop of the oil-bearing bed may be taken as a fair indication of the richness in oil at a greater depth. As the oil beyond doubt originated by the slow decomposition of the remains of water plants or animals in the bed of rock where it is now found; and as those remains were deposited on the bottom of the sea at the same time with the other materials of the rock, before the bed was tilted up or the valley scooped out and the present surface of the ground took shape; there is no reason whatever to suppose that there is at a distance from that surface any greater accumulation of such remains or of their resulting oily products than near the outcrop (making allowance,

however, for the small amount of drainage away of the oil that may have been taken place at points where the out crop is favorably situated).

If the trial of the out crop should however prove unexpectedly encouraging, borings might be made to some depth on the outside of the half circle (roughly speaking) which the outcrop forms. On the westerly side of the axis the depth of the bed increases in the direction of the dip at the rate of 100 feet for every 272 feet of distance or thereabouts, to a depth of perhaps 300 feet below sea level and somewhat more rapidly after that. But on the easterly side of the axis the depth increases much faster; at the place where the dip is 45° the depth of course would become 100 feet more for every 100 feet of distance; and where the dip is 65 degrees the bed would be 100 feet deeper at only some 47 feet of distance. In estimating the depth of any proposed boring and reckoning from the comparatively regular curved line where the bed would be found at sea level it must be borne in mind to add the height of the ground to the calculated depth of the bed below sea level. It would of course be very foolish to begin at once with a very deep boring; for borings made by hand to a depth of a hundred feet or so would amply test the bed. In case of good success with them it would be time enough to make deeper and more costly borings.

6. *Shipment.*—Although there are no roads now close about the oil wells, yet as the land is all nearly open and free from any obstacle, it would be very easy to make even a wagon road for carrying away the oil that might be found. Pack-horses can already go almost everywhere there. The oil could either be carried by land along the present bridle-path or an easily built wagon road to Hakodate, twenty miles (8 ri), or in fair weather could be shipped thither by boats or larger vessels from

either of the slightly shetered roadsteads of Kamaya or Idzumisawa or even from the more exposed shore close by the Wells.

7 *Map.*—The map shows by contour lines ten feet apart in level the height and shape of the ground for half-a-mile or more in all directions from the oil-wells. The probable shape and position of the oil-bearing bed of rock is also shown by similar but much more regularly curved (broken) lines drawn for the sea level and for other levels 100 feet apart down to 500 feet below the sea. The probable outcrop of the bed is also shown by short close lines drawn across it. The map therefore shows at once what parts of the land are underlain by the bed above 500 feet below sea level, and in what direction it would be useless to search for the out crop of the bed by digging or for lower portions of the bed by boring.

In order to lay down on paper the shape of the ground and the position of the rock exposures it was necessary of course to take the levels of many fixed points. That was done by running with the prismatic compass many lines (mostly straight ones at right angles with one another, but sometimes along streams or the sea shore) and levelling (with the hand level) points not more than 200 feet apart (by pacing) and often additional intermediate ones. Stakes were set up at the regular 200 foot stations, and to each one was given a separate mark. Such stations and their marks are reproduced on the map; so that by means of the stakes any desired point of the map may be found on the ground.

The position of the axis is also marked on the map, and a section showing the arch or saddle shaped structure of the rock bed is drawn for a line passing through the main oil well at right angles with the axis.

The surveying was done by Messrs. T. Yamauchi, T. Kuwada, J. Takahashi and T. Saito, Assistant Geologists,

under very general instructions only. Each line was plotted and its topography drawn by its surveyor; but Mr. Saito tookmore particular charge of putting together, adjusting and copying the plottings into one map and after his absence, when the work was in great part done, Mr. Kuwada took his place. The whole has been traced by Mr. M. Kubota on white cloth in black strong lines so as to be fit for photographic. The lettering hasbeen worked out by Messrs. S. Misawa and T. Inagaki, Assistant Geologists. The whole of the final mapping has been done under my own eye; and in particular the geological observations and the mapping of the oil-bearing bed were my own work.

I have the honor to be,

Sir,

Your most obedient Servant,

BENJ. SMITH LYMAN,

Chief Geologist and Mining Engineer to the Kaitakushi.

Shiba, Yedo;

26 April, 1875.

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REPORT

OF A

ROUGH SURVEY

(IN 1873)

OF THE

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1.—SITUATION.
2.—LAY OF THE LAND.
3.—GEOLOGY.
4.—OIL.
5.—WORKING THE OIL.
6.—LIME-STONE.
7.—MINERAL WATER.
8.—SHIPMENT.
9.—MAP.

GENERAL HORACE CAPRON,
Commissioner and Adviser to the Kaitakushi.

SIR,

I have the honour to make you the following report on the Washinoki Oil Lands.

1.—*Situation.*—The Washinoki Oil Lands are on the Washinoki Brook at the western outskirts of the village of that name on the south-westerly shore of Volcano (or Edomo) Bay, about 2½ miles (1 ri) north-westerly from Mori, and 30 miles (12 ri) from Hakodate,

2.—*Lay of Land.*—The shore of the Bay near the oil-lands runs north-westerly, and the Washinoki Brook meets it at about right angles. The land rises steeply on the seashore and on both sides of the Brook, and shows remains of terraces at heights of about 45 feet, 75 feet, 160 feet, 200, feet 230 feet, 255 feet, 280 feet, 300 feet, 375 feet, 420 feet, 500 feet; and rises at a mile and a half from the sea into hills 600 feet high on either side of the Brook, and, a quarter of a mile further back, into one 700 feet high on the north-west. The two lower terraces are especially well marked along the sea shore; some of the others appear only in scattered traces further inland, and may perhaps be doubtful.

The oil exposures are along the brook from a third of a mile (in a straight line) to three-quarters distant from the sea. The village reaches to the mouth of the Brook but lies chiefly to the south east of it. The land covered by the survey, about three-quarters of mile or more in all directions from the Main Well (the uppermost exposure), is almost without an exception wild; and for the most part covered with light woods or at least brush.

3.—*Geology.*—On the Brook there are numerous rock exposures that show the dip, and the structure of the beds to be that of a saddle or anticlinal with a basin or synclinal on either side and with many smaller, subordinate waves on the surface of the main ones. The axis of the saddle seems to cross the Brook at a point about 500 yards from the sea, and to run S. S. W. by S. passing about 1100 feet easterly of the main well. The dips on the westerly side of the axis along the Brook are generally very steep, 65 degrees or 70 degrees; but lower down stream near the axis become 40 degrees or 30 degrees; and, near the sea, on the easterly side of the axis, only 20 degrees or less.

Besides the dips observed on the Brook there are some

on the sea shore at the limestone exposure three-quarters of a mile northwest of Washinoki, showing a sharp basin or synclinal in the rocks. It is perhaps the same basin that crosses the Brook 1000 yards above the Main Well. At the sea shore the dip is 85 degrees on the westerly side of the axis of the basin and only 60 on the easterly side at 20 yards from the axis. On the Brook the dips on either side of the axis and near to it are 60 degrees or 70 degrees ; but on the westerly side become gentler to 20 degrees at 250 yards from the axis, though steeper again to 40 degrees or more within 150 yards further off.

The rocks all doubtless belong to the Toshibets group and are chiefly soft greenish (or bluish) gray sand rock. Only two or three imperfect fossils were found here ; but those seen at other places are so recent looking as to make the group seem to be of late Tertiary age, in spite of the steepness of its folds here and elsewhere.

There seem to be two oil-bearing beds about 200 feet apart, and each perhaps less than ten feet thick ; but there is also a little oil that may possibly come from another bed within fifty feet above the lower one; though probably merely the result of drainage through the alluvium from the outcrop of the lower bed above on the hillside near by. It is possible, too, that the whole thickness from the uppermost to the lowermost of the two or three beds is more or less rich in oil, though there happen to be no exposures to show it. The main well and apparently the chief yield of oil are in the lower bed.

Besides the oil bearing beds about 220 feet apart and the lime-stone beds about 300 feet still lower, there are here and there on the Brook exposures of rock through a thickness in all of perhaps 1,200 feet, reaching to some 300 feet below the lime-rock ; and they are almost invariably soft, greenish-gray sand rock. In a few cases, however, as at the upper oil bearing bed there are in the

rock angular fragments or rounded pebbles of volcanic material.

4.—*Oil.*—The oil exposures are at five different places, with more than one small well sometimes at a single place or within a space of a few yards.

The Main Well is at the place farthest up stream. It was dug in 1872 by Mr. Enomoto's directions, and is a hole somewhat triangular in shape, now divided in two. The small hole, is about two feet long by a foot and a half wide and half a foot deep ; the larger one is about eight feet long by three wide and half a foot deep. The smaller hole yields a very large share of the oil, which chiefly issues below and at one corner from a crack in greenish-gray soft sand rock at the foot of a small cliff about ten feet high and of a low steep hill-side. The same bed of rock above shows no signs of oil. Some layers below are coarser, harder, grayer and more mixed in material ; and at one point bear a white efflorescence. About 15 feet of thickness of rock in all are exposed. The oil is thick, black and tarry and so heavy as to mark (when fresh) 15 degrees of Beaumé's scale at 60 degrees Fahrenheit. A few small gas bubbles rise from the bottom of the small hole. The larger hole is wholly in alluvial gravel between the small hole and the Brook ; and the oil seems to pass from the small one into the larger one at a lower level, and is of the same character. The oil that had accumulated during the past year was gathered, and amounted to about three pints (1 sho) for the small hole, and 14 quarts (9 sho) for the larger one or four gallons (1 to) in all. The next two days the small hole yielded a daily average of about seven pints ($2\frac{1}{2}$ sho) ; and the larger hole about $4\frac{3}{4}$ pints ($1\frac{1}{2}$ sho); or in all nearly 7 quarts ($3\frac{3}{4}$ sho).

The next place, perhaps, in importance is the lowermost but one on the brook and about 400 yards north-

east of the Main Well. It was likewise opened in 1872 by Mr. Enomoto; and is about three feet long by two wide, close to the brook at the foot of a steep bank, and seems to be on a bed of rock 220 feet above that of the Main Well. The oil comes from a greenish gray soft sand rock with feldspathic grains as well as quartz. Small bubbles of gas rise here. The oil is of much the same appearance and character as that of the Main Well, but even heavier; for it marked (when fresh) only 12½ degrees of Beaumé's scale at 60 degrees of Fahrenheit. About 11 quarts (7 sho) of oil were gathered as the accumulation of the past year; and the two next days about 1½ pints (½ sho) were obtained each day. About ten feet up stream and ten feet from the river and ten feet above it there is more of blackish rock and a very little oil issues from a layer half a foot thick of gray sand rock.

The next uppermost place to the Main Well is about 200 yards down stream; and seems to be upon or very close to the out crop of the rock bed of that well, though possibly on the outcrop of another bed within fifty feet above. There are within a score of yards or so four small holes there wholly in the alluvium; and one of them is said to have been first dug forty years ago. It is in gray sand about five yards from the foot of the bluff, is about 3½ feet in diameter and 1½ feet deep, and is half full of water with a thin brownish coating of oil. A few yards to the north-east are two shallow holes about a yard in diameter in the alluvial gravel at the foot of the bluff. The nearer one had very little oil but the other had a good black film of it, a single day's accumulation. This one seems also to be at the edge of greenish-gray, soft, coarse sand rock that is exposed 15 feet above in the bank, with apparently a fossil or two. The fourth oil exposure is a few yards to the north-west on a small

island in the brook, and is in a hole of about a yard in diameter dug in the brook gravel. Within two days after it was dug by Mr. Yamauchi a thick black coating of oil had gathered on the water in the hole; and small bubbles of gas were rising abundantly.

At the lowermost oil place on the brook, apparently on the outcrop of the same bed of rock as the second place a little oil issues from a one foot layer of bluish-gray sandy shales in the midst of a breccia of mostly whitish but partly blackish feldspathic fragments, apparently of volcanic rocks. The oil just covers with a thin brownish film a triangular pool of water about two feet long by half a foot wide, and amounts therefore to extremely little. For about ten yards up stream oil issues from the breccia for the space of a foot above the edge of the water of the brook; and at the upper end of the ten yards the breccia is exposed to some 20 feet in height, overlain by some 20 feet more of greenish-gray soft sands and light brown sands with perhaps some more breccia fragments in a thick band below the middle. For the next eight yards up stream the breccia at the water's edge is covered with rubbish; but for ten yards further up the oil covers the surface of the breccia for two feet from the edge of the brook and for 15 yards still further, to the upper end of the exposure, reaches to about three feet above the water.

The only other oil place is 400 yards N. E. of the main well and no doubt on the outcrop of the same bed of rock and 100 yards above the second mentioned place, and has one oil spring, a hole about four feet long by two wide and three-quarters of a foot deep, full of water covered with a thin brownish black film of oil. Gas rises in large bubbles at one corner and at the opposite end and in small bubbles at another point. The hole is at the foot of a steep bank and cliff, where soft greenish-gray sand rock

with here and there half foot layers and thinner of small (filbert size) breccia. Above the spring there is no sign of oil in the rock and the alluvium below seemed at the time to be the source. About five yards down stream and five yards further from the brook there is a somewhat separate part of the cliff where we found a couple of imperfect fossils (shells ?).

The whole yield of oil then at the time of the survey (October, 1873) was only some two gallons (5 sho) a day. A hearsay report has reached me that further trials were made in 1874, and a daily yield of fifty gallons a day obtained; but I know nothing whatever as to how exact the statement may be. No asphalt was noticed near the wells.

6. *Working the Oil.*—Neither the yield observed by us nor even the rumored result of the trials made through the whole of last season give very much encouragement to further efforts; although the lands are evidently much richer in oil than any others in Yesso. If, however, it should be desired to make more trials our present map would be a guide, and the search for the oil-bearing beds would not be wholly at random, as it has been hitherto. The outcrop of the rock bed that bears the oil of the Main Well seems to run with many small irregularities, S. S. W. from that well, in the same general course as the Brook and mostly very close to it, for about two thousand feet. Then for another two thousand feet with a gentler dip as it approaches the axis of the basin or synclinal, it runs more southerly and then south-westerly rising to the crest of a high ridge 380 feet above the sea; and then turns northerly across the Brook towards the sea shore probably making an ess shaped curve before arriving there near the Ombi limestone. The precise place of the outcrop in this distant portion is, however, owing to the absence of rock exposures, much less certain than

cated machinery worked by horses or other animals, or possibly even a steam engine. The wells would be deeper and deeper the further from the outcrop: along the Brook near the main well about 100 feet deeper for every 36 feet of distance northwesterly from the outcrop; on the easterly side of the axis of the saddle perhaps 100 feet deep for every 220 feet of distance north-easterly from the outcrop; and on the westerly side of the basin perhaps 100 feet deeper for every 63 feet of distance easterly from the outcrop. On the axis of the basin or synclinal the depth would increase by perhaps 100 feet for every 375 feet of distance northerly; and on the axis of the saddle or anticlinal, by perhaps 100 feet for every 220 feet of distance northerly.

6. *Limestone.*—At a spot called Ombi, about three quarters of a mile north-westerly from the mouth of Washinoki Brook, some gray limestone rather impure looking with clay is exposed on the sea shore. The rock beds there form a narrow basin which seems likely to be the same as that on the Brook half a mile south-westerly from the Main Well. A block of limestone a foot long was also found on the Brook about three quarters of a mile south-westerly of the Main Well, and no doubt a bed of lime rock crops out somewhere near, though it was not found. The strike of the rocks there and at the Ombi limestone makes it seem very probable that both exposures belong to the same bed. In that case, the lime rock underlies the lower oil-bearing bed at a depth of about 300 feet, and has a very long outcrop that runs not only from the sea shore to the Brook exposure but still somewhat further inland; then turning north-easterly again crosses the axis of the basin outside of the curve of the oil bearing beds and passes nearly parallel, in general, to the out crop of the lower oil-bearing bed and goes over the axis of the saddle inside the curve of that bed;

and thence runs south-south-easterly at some three quarters of a mile further inland than the outcrop of the same bed. The lime rock at Ombi is so impure that perhaps only four yards in thickness would be workable. Even that is somewhat impure, but may make strong lime. There are besides some half-a-dozen feet in thickness of shales that look limy. Four yards in thickness with such an outcrop as already described, about four miles long within the limits of the survey, would contain about 86,000 tons within five yards of the surface. In spite of the rarity of lime-stone in this part of Yesso, it is not likely that it would ever pay to work the bed to a much greater depth, if even so deep, especially as it is separated by shales into several layers some inches or even feet distant.

7. *Mineral Water.*—The Yunosaki Mineral Spring mentioned in my report of 25th December, 1873, is 500 yards northwest of the mouth of Washinoki Brook, and about 40 yards from the sea and some 30 feet above it on the hill side. The spring is merely in the alluvial surface earth and is so small as to be curbed with a little tub; and the flow of water seems to be very slight. There is a little reddish iron rust before the spring where water has been spilt. The water is cold, free from gas bubbles and is not drinkable for it has a very sharp taste like copperas and burns the tongue. Nearly opposite the spring there are for 17 yards along the beach very numerous little springs where water bubbles up through holes an eighth or a quarter of an inch in diameter in the sand. The water is cold and tastes only of the sea salt which overflows it at every wave.

8. *Shipment.*—There were no roads at the time of the survey near the oil exposures, except the one along by the sea shore, but either bridle paths or wagon roads could easily be built up the valley of the Brook about

nine-tenths of a mile (one-third of a ri) to the Main Well; and even beyond, if oil should be found at new places. The oil could be carried from the mouth of the Brook either by the present bridle path or by some future easily built wagon road about a ri to Mori, whence it could either be shipped on vessels from the wharf or be carried by the new wagon road to Hakodate. In fair summer weather the oil might even be loaded with the help of small boats upon vessels lying off the exposed shore of Washinoki.

9. *Map.*—The map aims to show the shape and height of the ground and the probable place of the outcrop and sea level line of the two oil-bearing beds and of the limerock bed, and more fully the shape and position of the lower or main oil-bearing bed at other levels. The shape and height of the ground are shown by contour lines drawn at ten feet apart in level; those of the lower oil bearing bed by broken lines drawn upon it at 100 feet apart in level. It needs then but a glance to see what parts of the field are underlain by the bed and in what parts it would probably be quite useless to bore for oil. The upper oil bearing bed would have the same shape as thelo wer and its hundred foot contour lines would be about parallel to the lines of the lower bed Adding the height of the ground above the sea to the depth of the bed below sea level at any point would give the full depth of a boring there.

The numerous stakes set up at the principal surveying stations which were levelled to get the height and shape of the ground were commonly 200 feet apart in straight lines; and such points are marked with a dot on the map and with the letters or numbers which distinguish them; so that it may be possible to find any point of the map on the ground, or any point of the ground on the map.

The structural axes of the rock beds are also marked

on the map, and the structure is further shown by a cross section drawn at right angles with them.

The surveying was done by Messrs. T. Yamauchi, T. Kuwada, J. Takahashi and T. Saito, Assistant Geologists, under very general instructions only. They plotted each their own lines and drew the topography; but Mr. Takahashi has had special charge of putting the whole together into one map with the needfull adjustments and copying. Mr. K. Makino traced the map with strong black lines on white cloth with a special view to photographing. You see that Mr. Takahashi has not yet finished the lettering but he will do so within a very few days, probably in ample time for the photograph to accompany the printed report. The whole of the final mapping has been done under my guidance, and the geological observations and mapping of the rock beds were my own.

I have the honor to be,

Sir,

Your most obedient servant,

BENJ. SMITH LYMAN,

Chief Geologist and Mining Engineer to the Kaitakushi.

Shiba, Yedo, 29th April, 1875.

GEOLOGICAL SURVEY OF HOKKAIDO.

SKETCH

OF THE

NEARLY FINISHED

MAPS AND REPORTS

OF THE

GEOLOGICAL SURVEY,

BY

BENJ. SMITH LYMAN,

CHIEF GEOLOGIST AND MINING ENGINEER.

TOKEI:
PUBLISHED BY THE KAITAKUSHI.
1875.

GEOLOGICAL SURVEY OF HOKKAIDO.

Sketch of the Nearly Finished Maps and Reports of the Geological Survey, by Benjamin Smith Lyman, Chief Geologist and Mining Engineer.

General Horace Capron,
Commissioner and Adviser to the Kaitakushi.

,Sir

I have the honor to make the following report on the present condition of the maps and reports of the Geological Survey.

Besides the Maps already finished of:—

1.—Chatsunai and Shibui Harbors about 1.90 feet × 1.50 feet.....scale $\frac{1}{1000}$

2.—Ishcari and Otopchi Rivers 0.70 × 0.48... „ $\frac{1}{1000000}$

3.—Yamukushinai Oil Lands 1.12 × 1.12..... „ $\frac{1}{5000}$

4.—Idzumisawa Oil Lands 1.68 × 1.24..... „ $\frac{1}{5000}$

there are now maps in progress, and for the most part nearly finished of:—

5.—Washinoki Oil Lands about 2.00 × 1.82.. „ $\frac{1}{5000}$

6,—Sorachi Coal field (sketch) 1.16 × 0.98,.. „ $\frac{1}{12960}$

7.—Geology of Yesso in colors (sketch)
1.29 × 0.92..... „ $\frac{1}{2000000}$

8.—Kayanoma Coal Field about 3.80 × 3.15 scale $\frac{1}{5000}$

9.— „ cross sections „ 3.50 × 1.50 „ $\frac{1}{5000}$

10.—Poronai Coal Field „ 2.40 × 1.70 „ $\frac{1}{5000}$

11.— „ Cross sections „ 2.40 × 1.35 „ $\frac{1}{5000}$

12.—Noppaomani and Kawanai 3.53 × 3.53 „ $\frac{1}{5000}$

13.—Bibai Ccal Field 4.74 × 2.60 „ $\frac{1}{5000}$

14.—Poronai to Noppaomanai 1.28 × 0.87 „ $\frac{1}{5000}$

15.—Kawanai to Ishcari River 9.50 × 0.60 „ $\frac{1}{5000}$

16.—Poronai to Horumui about 4.50 × 0.55 „ $\frac{1}{5000}$

17.—Makumbets Coal Field 2.50? × 1.20? „ $\frac{1}{5000}$

18.—Iwaonobori Sulphur
(?) about 0.70 × 0.40 „ $\frac{1}{5000}$

19.—Nuburibets and Oi
Lake sulphur (?) „ 1.00? × 1.00? „ $\frac{1}{5000}$

20.—Esan „ (?) „ 0.80 × 0.50 „ $\frac{1}{5000}$

21.—Kobui „ (?) „ 0.50 × 0.50? „ $\frac{1}{5000}$.

22.—Okotsunai Iron
sand ..... (?) „ 1.25 × 0.75 „ $\frac{1}{5000}$

23.—Itashibeoni
sulphur..... (?) „ 1.25 × 0.75 „ $\frac{1}{1000}$

24.—Herashibets
River & Coal (?) „ 0.50 × 0.50 „ $\frac{1}{100.000}$

And Mr. Munroe says he has in progress the following maps of;—

25.—Toshibets Gold Field about 2.67 × 4.67 „ $\frac{1}{5000}$

26.—Reconnaissance of Toshibets Riyer (sketch) ..... „ 1.33 × 1.67 „ $\frac{1}{100.000}$

27.—Kudoö Gold Field „ 2.25 × 3.33 „ $\frac{1}{5000}$

28.—Esashi Gold Field „ 1.17 × 2.33 „ $\frac{1}{5000}$

29.—Yurap Lead Mines (unfinished survey) „ 1.00 × 1.33 „ $\frac{1}{5000}$

30.—Musa Gold Field, Sheet No. 1, 1,83 × 3.50 „ $\frac{1}{5000}$

31.— „ „ „ „ 2, 1.83 × 3.50 „ $\frac{1}{5000}$

32.—Travels in Yesso (Sketch) No. 1, 1.83 × 2.50 „ $\frac{1}{400000}$

33.— „ („) No. 2, 1.33 × 2.00 „ $\frac{1}{400000}$

Of reports, besides those already printed of:

1.—The first season's work, dated 25th Dec., 1873.
2.—Yesso Coals, dated April, 1874.
3.—Geological Trip through Yesso, dated November and December, 1874
4.—Yamukushinai Oil Lands, dated 17th April, 1875.
5.—Idzumisawa Oil Lands, dated 26th April, 1875.
6.—Washinoki Oil Lands, dated 29th April, 1875.

there will be reports on:

7.—Sketch of the Geology of Yesso.
8.—Kayanoma Coal Field.
9.—Poronai Coal Field.
10.—Noppaomanai and Kawanai Coal Field.
11.—Bibai Coal Field.
12.—Makumbets Coal Field.
13.—Toshibets Gold Field.
14.—Kudoö Gold Field.
15.—Esashi Gold Field.

16.—Yurap Lead Mines.

17.—Musa Gold Field.

18.—Tokachi Gold Field.

There will also perhaps be at least three or four other brief reports, and, possibly, a few very small maps of special portions of the field work that has been already done but not yet fully enough reported on or mapped.

The sketch map of the Geology of Yesso is to show the observed and conjectured place throughout Yesso of the following rock groups:—

	Thickness in feet.
Alluvium (new) perhaps not more than ...	100?
Bluff deposit (or old alluvium)	100?
New Volcanic rocks	200?
Toshibets Group	3,000?
Old Volcanic rocks...	3,000?
Horumui Group	4,500?
Kamoikotan Group	3,000?

That seems to be in general their order according to age from newest to oldest. The Toshibets Group is both the Toshibets Karafto and the Horumui Karafto group of my report of 25th December, 1873; and seems to be the source of all the gold, oil and wood-like lignite that have been found. It has such recent looking fossils as to seem to be of middle or later Tertiary age. Its rock beds have however at times a dip about vertical though large spaces, as on the Horumui; but sometimes, as clearly seen on the Ishcari below Kamoikotan, suddenly change from such a long continued vertical dip to an equally wide spread nearly horizontal one. The Old Volcanic rocks include doubtless the Toshibets Kuril Group of that report and some of them are of granitic structure, syenite and perhaps even granite proper. The Horumui Group is the Horumui Kuril Group of that report of 1873 and contains all the coal beds. It is per-

haps of older Tertiary or possibly late Secondary age. The Kamoikotan Group takes in the blackish quartzites of Kamoikotan and the upper Ishcari together with their limestone and serpentine; also the impure limestone of Birô and the limestone of Garonosawa; and every where seems to be very highly metamorphosed. No fossils have been found in it any where; but it has the appearance of great age, at any rate much greater than that of any of the other groups, and was probably the first nucleus of the island.

In 1873 the groups had been examined only in the comparatively small southern part of the island of Yesso, and seemed to be well enough distinguished by the direction of their structural axes which appeared to be very uniform and strikingly parallel to the Kuril Islands, North some 50 degrees east (magnetic), and to Karafto (or Sagalin), nearly north and south. But on going through and around the rest of the island no such uniformity seems to persist; and the Horumui Group seems in the Akkeshi region near the eastern end of the island to have a general strike of nearly north and south; while the Old Volcanic Rocks near Sôya at the north end of the island seem also to have a general strike of about north and south; and these must undoubtedly be the rocks of the southern end of Karafto itself, where the north and south structure appears to be especially well marked.

No rocks older than the Kamoikotan Group seem to have been found any where in Yesso. Although pebbles of true granite occur at Birô, none has yet been found in place, so that its age is quite uncertain. All the syenite and other granitic rocks hitherto found in place are no doubt of Old Volcanic origin and therefore comparatively new.

In respect of economical Geology, coal continues to be

almost the only workable mineral yet known in Yesso. The Horumui (or Poronai) coal is no doubt a part of the same field with the Sorachi coal and the Noppaomanai and Bibai coal are connecting links between the two. It is not improbable that the coal rocks extend continuously eastward as far as to the Makumbets coal not far from Uragawa on the East coast. But although that coal is said to be the best of the several exposures known on that part of the coast, there seems to be, as in the Akkeshi region still further east, only one workable bed (or possibly two) and that only barely so. Nevertheless the Horumui and Sorachi productive field seems to be a large one, perhaps 25 miles in diameter; though hardly accessible except by the Ishicari River. Coal is said to have been found in place on the west of that river within two or three ri of Uraushinai; and though the coal on the Rurumoppe side of the mountains seems to be unworkable (as on the Herashibets), yet the numerous bits of coal at the mouth of the Uriu and other western branches of the Ishcari may lead to a field of some size including that Uraushinai coal; and perhaps reaching northerly to the neighborhood of the Ambeshinai branch of the Teshio River. The whole of the rest of the northern and northeastern portions of the island seems to be made up of volcanic rocks, chiefly old; while the centre and southeast are made up of the Kamoikotan Group, partly covered by new volcanic rocks; and around Akkeshi of unproductive coal rocks. There appears therefore to be no possibility of any future discovery of very useful minerals in those by far the larger portions of the island. The Itashibeoni sulphur already described may prove worth working there, but the Meakan sulphur is hardly likely to be so; and nothing else is even so encouraging as they are. Iron sand is found in traces at very many points on the coast, but nowhere anything like

so abundantly as at Okotsunai and Yamukushinai on the shore of Volcano Bay. Some bog iron ore was found last season near Sapporo but has not yet been properly examined either geologically or chemically. The carbonate of iron is found in small quantities and of poor quality at several places but is nowhere workable. Manganese, lead, zinc, copper and silver ores have not even been found in traces except at the places in the southern part of the island reported on in 1873, and none of them are workable.

Mr. Munroe has continued his examinations of the gold fields and his detailed report on them is almost ready. He gives now the following practical results :

" *Toshibets Gold Field* area .....9,674,000 sq. metres

" Area of main terraces, available for washing .....5,305,000 „

" Area of river bed and flood plain-difficult to wash..... 200,000 „

" Area of poor ground (by difference) including high terraces and terrace slopes ..... 169,000 „

"Area of old workings—(estimated) some 160,000 sq. metres (to be deducted from the area of main terrace).

" Area of tributary valleys, containing little or no gold—omitted.

" Average thickness of gravel (data imperfect) some 3 metres.

" Average value of gravel, giving greater weight to results representing larger areas 5 *sen per cubic metre* ; poor ground 2 *sen.*

" *Kudoö Gold Field* area.....1,528,000 sq. metres.

" Average thickness of gravel, $1\frac{1}{2}$ metres .....2,292,000 cubic „

" Average value of gravel (as above)..$^{35}/_{100}$ of one *sen.*

"*Esashi Gold Field.*—area some 6 ri by about 1 ri, including both valley and intervening marine terrace.

"Value of gravel, $^{6}/_{100}$ of one sen. Thickness, perhaps, 2 metres.

"*Jimikishi.*—578,000 sq. metres; 1.8 metres thick; Value 1 sen per cubic metre.

"*Musa Gold Field.*—area .....7,976,000 sq. metres.

"Area of main terrace.....4,101,000 „

" " river bed and bottom land .....3,875,000 „

" „ high terraces, hill-sides, and tributary valleys omitted, poor.

"Average thickness of gravel 2.4 metres.

"Average value of gravel (calculated as above) $^{74}/_{100}$ sen per cubic meters.

"Area of old workings... 868,000 sq. m.
"Representing about.....1,500,000 cu. m. gravel.
"Now would be worth ... 21,000 yen in gold
"sand or would contain by weight, $9\frac{1}{2}$ kamme of
"gold"

"*Tokachi Gold Field*: area unknown: Thickness of "gravel some 15 to 25 metres; average value, $^{1}/_{100}$ of "one sen, and less!"

He adds in regard to the most nearly workable portions of the fields, only two in number: "The upper part of the Toshibets valley, with an area of about 1,000,000 square metres and an average thickness of gravel a little over three metres, will contain an average of $7\frac{1}{2}$ cents to the cubic metre, or about $5\frac{2}{3}$ cents to the cubic yard. It is of course possible that this will give a margin of profit if washed; but the profit will not be large. From this area should be deducted 20 per cent, at least to allow for ground already washed. An area of perhaps one or two thousand square metres 6 to 10 feet thick at the end of the main terrace near Yunoshiri, in the Musa Gold Field, will yield perhaps $8\frac{3}{4}$ sen per cubic metre or

6⅔ sen per cubic yard; but there is no water convenient, and the gravel would probably have to be carried on pack horses (or in cars?) one or two hundred yards."

There would therefore be in the Toshibets field about $180,000 of gold barely workable, and in the Musa Field about $400. It is satisfactory to have so definite a result of such a careful and thorough examination; and it sets at rest all schemes for washing gold in Yesso on a large scale, which would undoubtedly have proved disastrous.

The maps have of course taken more time than they otherwise would on account of the total inexperience of the assistants. It has seemed best to let them aid in every part of the work even when it might have been done more quickly without their help and the numerous explanations required. For in that way they gradually gain such experience and knowledge of the principles involved as to become more and more able to work without special guidance. Indeed it is quite a boast of the survey that the Japanese assistants, though the first Asiatics to learn the practice of geology, are doing so successfully, and that in a few years they may become so far accomplished that they can make satisfactory geological surveys without foreign aid. But of course it is not to be expected that they should gain such skill more rapidly than a foreigner who has a much better education to begin with. They seem to have no exaggerated impression of their own proficiency and skill; and above all they have learned habits of truthfulness, so especially essential in such work as theirs, and know the importance of careful exactness. They are therefore free from two of the greatest obstacles to their final success, which many incredulous foreigners have considered quite insurmountable in some parts of Asia. Much of the assistants' time in the winters has been taken from the

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